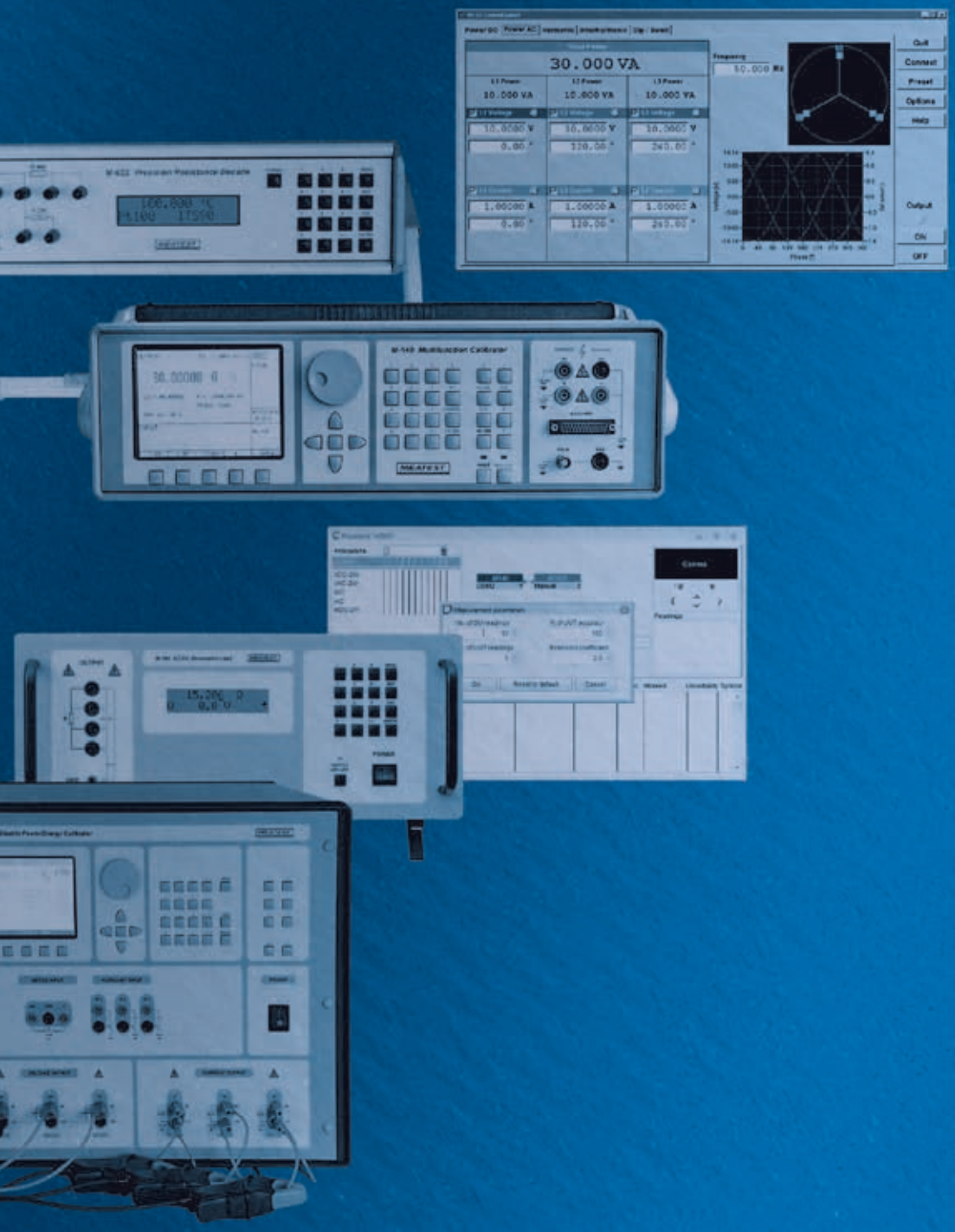
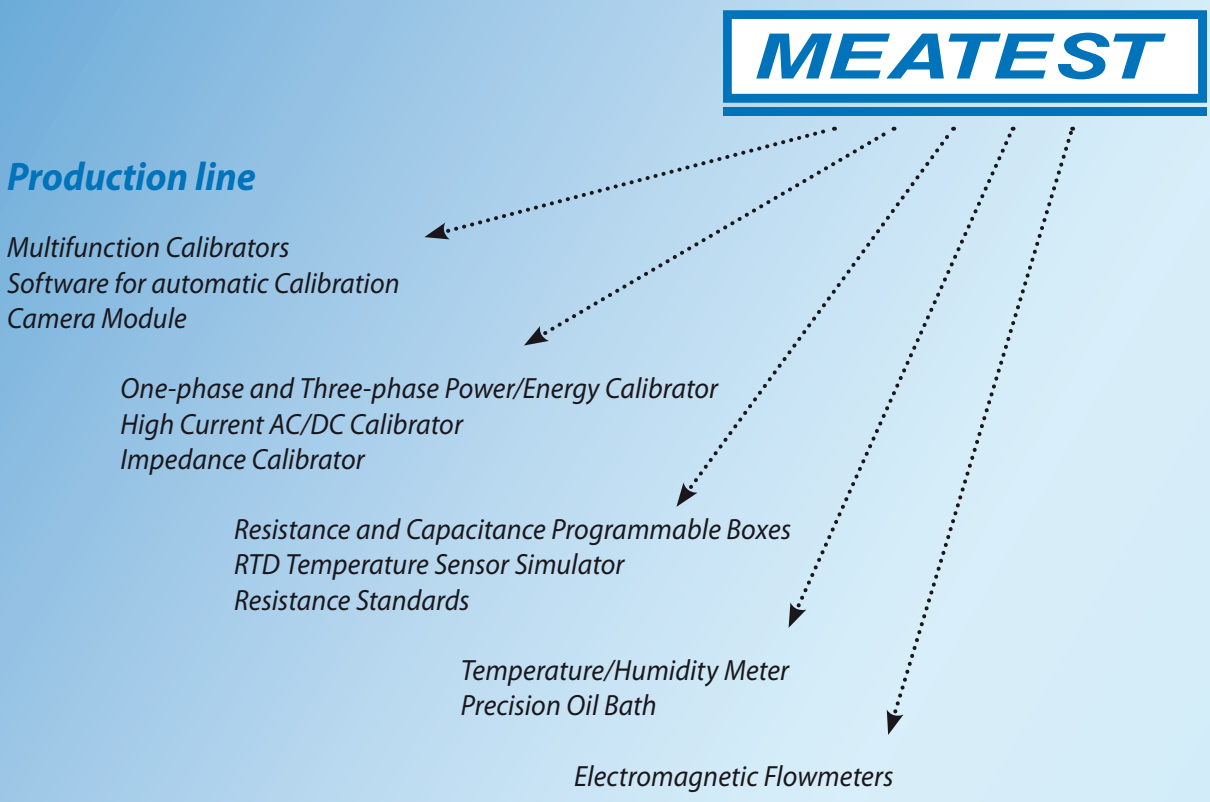


PRECISION INSTRUMENTS *for* MEASUREMENT *and* CALIBRATION

MEATEST

Production line



Company profile

Czech company MEATEST was found in 1991. Profile of company includes development, manufacturing and sale of instruments especially for use in calibration laboratories and for accurate measuring in industry. MEATEST is member of national metrology association Czech calibration association, Czech metrology association and Calibration association of Slovak republic.

Production

- *Multifunction and process calibrators, standards, instruments for metrology of electric quantities.*
- *Software and hardware accessories for computer-based automatic calibrations.*
- *Special instruments for metrology like Temperature oil bathes, Programmable resistance decades etc.*
- *Electromagnetic flowmeters for industrial application.*

Quality management system & Traceability

MEATEST quality management system is certified according to standard ISO 9001:2000.
All main processes manufacturing, development, sale, services and calibrations are certified and every year audited by Bureau Veritas Certification.

MEATEST main standards are traceable directly to the Czech national standards in Czech Metrology Institute (CMI). CMI laboratories are accredited by Czech institute for accreditation, a member of European co-operation for accreditation.

M-140 / M-142 Multifunction Calibrator Series

M-140

M-142

- AC/DC voltage/current to 1000V/30A
- Best accuracy 15ppm in DCV mode
- AC/DC Power/Energy, Phase shift
- Resistance, Capacitance, Frequency
- Build-in DC multimeter with Voltage/Current/Resistance/Frequency
- TC/RTD Temperature Sensor Simulation
- GPIB and RS-232 as standard

M-140/142 series represents category of multifunction calibrators of electric quantities for general application. Various versions offer different range of electric functions, accuracies and user comfortability. Build-in multimeter enables complex testing and calibrating of sources and meters of electric quantities. Multimeters, scopes, power meters, etc. can be directly calibrated with the instrument in sourcing mode. In measuring mode, the calibrator can be used for testing of DC voltage/current sources, for temperature measurements and for measuring other non-electric quantities through external sensors. Simultaneous generation and measurement allows calibration, adjusting and testing of various types of regulators, panel-meters, converters, indicators etc.
Either manual control from the front panel keyboard, or remote control via GPIB bus or via RS-232 is available.

Model	*DCV accuracy*	*DCV ACV*	*DCI ACI*	*Shape waveform*	*Power Energy*	*RTD simulation*	*TC simulation*	*Resistance*	*Capacitance*	*Frequency*	*Built-in multimeter*	*Interface*
M-140	35 ppm	1 000 V	20 A	Y	Y	Y	Y	50 MΩ	50 µF	20 MHz	Y	GPIB RS232
M-142	15 ppm	1 000 V	30 A	Y	Y	Y	Y	1 000 MΩ	100 µF	20 MHz	Y	GPIB RS232
M-140i	35 ppm	1 000 V	20 A	N	N	N	Y	N	N	N	N	RS232
M-142i	15 ppm	1 000 V	30 A	N	N	N	Y	N	N	N	N	RS232

M-140i

M-140 in 19˝ version

DC Voltage Ranges & Accuracy / 1 year

Range	*M-140/M-140i [ppm of value + V]*	*M-142/M-142i [ppm of value + V]*
0 µV – 20 mV	300 + 10 µ	50 + 6 u
20 mV – 200 mV	100 + 15 µ	15 + 8 u
200 mV – 2 V	30 + 16 u	12 + 10 u
2 V - 20 V	30 + 100 u	10 + 50 u
20 V – 240 V	30 + 1 m	20 + 500 u
240 V – 1000 V	50 + 50 m	50 + 20 m

DC Current Ranges & Accuracy / 1 year

Range	*M-140/M-140i [ppm of value + A]*	*M-142/M-142i [ppm of value + A]*
0 µA – 200 µA	500 + 20 nA	500 + 20 n
200 µA - 2 mA	200 + 100 nA	200 + 100 n
2 mA - 20 mA	100 + 600 nA	100 + 600 n
20 mA – 200 mA	100 + 6 uA	100 + 6 u
200 mA – 2 A	150 + 100 uA	150 + 100 u
2 A – 20 A *1	200 + 2 mA	200 + 2 m
20A – 30A *1	—	300 + 3 m

*1 Limited time of continuous current in range 10 to 30A

Specification

AC Voltage Ranges & Accuracy / 1 year

Range	M-140/M-140i [ppm of value + V]	M-142/M-142i [ppm of value + V]	M-140/M-140i M-142/M-142i [ppm of value + V]	M-140/M-140i M-142/M-142i [ppm of value + V]
	20 Hz - 10 kHz	20 Hz - 10 kHz	10 kHz - 50 kHz	50 kHz - 100 kHz
1 mV - 20 mV	2 000 + 30 µ	2 000 + 30 µ	2000 + 1000 + 20 µ	1.0 + 0.10 + 20 µ
20 mV - 200 mV	1 000 + 80 µ	1 000 + 80 µ	1500 + 500 + 20 µ	0.3 + 0.05 + 20 µ
200 mV - 2 V	250 + 100 u	180 + 100 u	500 + 200 µ	0.2 + 1 m
2 V - 20 V	250 + 1 m	180 + 1 m	500 + 6 m	0.2 + 10 m
20 V – 240 V *3	250 + 20 m	180 + 20 m	—	—
240 V – 1000 V	300 + 200 m *2	300 + 200 m *2	—	—

*2 valid for f < 1000 Hz; *3 frequency in range 200 to 240 V is limited to 1 kHz

AC Current Ranges & Accuracy / 1 year

Range	M-140/M-140i [ppm of value + A]	M-142/M-142i [ppm of value + A]	M-140/M-140i M-142/M-142i [ppm of value + A]	M-140/M-140i M-142/M-142i [ppm of value + A]
	20 Hz – 1 kHz	20 Hz – 1 kHz	1 kHz – 5 kHz	5 kHz – 10 kHz
1 µA – 200 µA	1500 + 20 n	1500 + 20 n	3000 + 220 n	—
200 µA – 2 mA	700 + 200 n	700 + 200 n	2000 + 1 µ	5000 + 1400 n
2 mA - 20 mA	500 + 1 u	500 + 1 u	2000 + 10 µ	5000 + 14 µ
20 mA – 200 mA	500 + 10 u	500 + 10 u	2000 + 100 µ	5000 + 140 µ
200 mA - 2 A	500 + 100 u	500 + 100 u	—	—
10 A – 20 A *4 *6	1000 + 6 m	1000 + 6 m	—	—
20 A – 30 A *5	—	20000 + 9 m	—	—

*4 Continuous output current maximum time is 60 sec for set value 20 A, for M-142 and 30 s for M-140.
*5 Continuous output current maximum time is 30 sec for set value 30 A.
*6 When Option 140-50 Current coil is used, add uncertainty 0.3 % of the set current to the value specified in the above table. Output current is multiplied by factor 50.

Function Shape (M-140 / M-142 versions only)

Range of voltage: 1 mV to 200 V
Range of current: 100 µA to 2 A
Output waveform: square, positive, negative, symmetrical, ramp A, ramp B, triangle, truncated sinus
Peak value accuracy: 0.3 %

Frequency (M-140 / M-142 versions only)

Type	Range	Frequency acc. [%]	Amplitude	Amplitude acc. [%]	Ratio [-]	Ratio acc. [-]
PWM (POS, NEG, SYM)	0.1 Hz–100 kHz	0.005	1 mV–10 V	0.1	0.1–0.99	0.0005
HSO *7	0.1 Hz–20 MHz	0.005	5 V_{pk-pk}	10	—	—

*7 Rise time of generated output waveform in HSO function < 5 ns

Resistance (M-140 / M-142 versions only)

M-140		M-142	
Range	ppm of value + mΩ	Range	ppm of value + mΩ
0 Ω – 100 Ω	300 + 10	0–10 Ω	300 + 5
100 Ω – 400 Ω	150	10 – 33 Ω	150 + 5
400 Ω – 2 kΩ	150	100 – 330 Ω	100 + 5
2kΩ – 10 kΩ	150	330–1 kΩ	100
10 kΩ – 40 kΩ	150	1 – 3.3 kΩ	100
40 kΩ – 200 kΩ	150	3.3–10 kΩ	100
200kΩ – 1 MΩ	500	10 – 33 kΩ	100
1 MΩ – 4 MΩ	1000	33 – 100 kΩ	100
4 MΩ – 20MΩ	2000	100 – 330 kΩ	100
20 MΩ – 50MΩ	5000	330 – 1 MΩ	100
		1 – 3.3 MΩ	200
		3.3–10MΩ	500
		10 – 33 MΩ	1000
		33–100 MΩ	2000
		100 MΩ – 1 GΩ	5000

Maximal compliance voltage on output terminals 5-8Vpk for model M-140 and 10-20Vpk for model M-142.

Capacitance (M-140 / M-142 versions only)

M-140		M-142	
Range	% of value + pF	Range	% of value + pF
900 pF – 2.5 nF	0.5 + 15	700 pF–1 nF	0.5 + 15
2.5 nF – 10 nF	0.5	1 nF–3.3 nF	0.5 + 5
10 nF – 50 nF	0.5	3.3 nF – 10 nF	0.5
50 nF–250 nF	0.5	10 nF–33 nF	0.5
250 nF – 1 µF	0.5	33 nF–100 nF	0.5
1 µF–3.5 µF	1	100 nF–330 nF	1
3.5 µF – 5 µF	1	330 nF – 1 µF	1
5 µF–10 µF	1.5	1 µF–3.3 µF	1.5
10 µF – 50 µF	2.0	3.3 µF–10 µF	1.5
		10 µF – 100 µF	2.0

Maximal compliance voltage on output terminals 5.5 Vpk.

Specification

AC/DC Power & Energy (M-140 / M-142 versions only)

Function	*Range*	*Accuracy*
DC Voltage	0.2 V–240 V	40 to 150 ppm
DC Current	M-140: 2 mA–10 A M-142: 2 mA to 20A	500 to 1500 ppm
AC Voltage	0.2 V–240 V	300 to 1200 ppm
AC Current	M-140: 2 mA–10 A M-142: 2 mA to 20A	500 to 1500 ppm
Frequency	20–400 Hz	50 ppm
Power factor	-1 to +1	0.005–0.0005
Phase	0–360 °	0.15–0.25 °
Time in energy mode	10 s to 1999 s	0.1 s

Accuracy of AC power depends on set value of voltage, current, phase. Best accuracy is 0.08 %.
Accuracy in energy mode depends on set value of voltage, current, phase and time. Best accuracy is 0.09 %.

RTD Temperature Sensor Simulation (M-140 / M-142 versions only)

Type: Pt 1.385, Pt 1.392, Ni
Range of R0: 20 Ω to 2 kΩ
Range of temperature: -200 to +850 °C
Temperature accuracy: 0.04 °C to 0.5 °C
Temperature scale: ITS 90, PTS 68

TC Temperature Sensor Simulation

R	range [°C]	-50–0	0 – 400	400–1000	1000–1767
	accuracy [°C]	3.2	2.1	1.4	1.7
S	range [°C]	-50–0	0 – 250	250–1400	1400–1767
	accuracy [°C]	2.7	2.1	1.7	2.0
B	range [°C]	400–800	800 – 1000	1000–1500	1500–1820
	accuracy [°C]	2.8	1.8	1.6	1.8
J	range [°C]	-210 – -100	-100 – 150	150–700	700–1200
	accuracy [°C]	0.9	0.5	0.6	0.7
T	range [°C]	-200 – -100	-100 – 0	0–100	100–400
	accuracy [°C]	0.9	0.5	0.4	0.4
E	range [°C]	-250 – -100	-100 – 280	280–600	600–1000
	accuracy [°C]	1.6	0.4	0.5	0.5
K	range [°C]	-200 – -100	-100 – 480	480–1000	1000–1372
	accuracy [°C]	1.0	0.6	0.7	0.8
N	range [°C]	-200 – -100	-100 – 0	0–580	580–1300
	accuracy [°C]	1.2	0.7	0.6	0.8

Multimeter (M-140 / M-142 versions only)

Quantity	*Range*	*Accuracy*
DC voltage – DCV	0 to +/-12 V	0.01 % +500 µV
DC voltage – mVDC	0 to +/-2 V	0.02 % +7 µV
DC current	0 to +/-25 mA	0.015 % +300 nA
Frequency	1 Hz to 15 kHz	0.005
Resistance	0 to 2 kΩ	0.02 % + 10 mΩ
RTD temperature	-150 to +600 °C	0.1 °C
TC temperature	-250 to +1820 °C	0.4 to 4 °C
SGS sensors *8	depends on the sensor	0.05 % + 10 µV +sensor unc.

*8 M-140 model only

Voltage	2 to 10 V DC
Input impedance	min. 100 MΩ
Sensitivity	0.5 mV/V to 100 mV/V
Displayed unit	programmable
Sorting function	1 x closure, 1 x opener
Max. supply current	40 mA

General data

Warm up time: 60 min
Temperature: Storing 0 to 40 °C @ max. 80 % r.h.
Reference 23 °C ± 2 °C
Dimensions / Weight: 450 x 480 x 150 mm / 23 kg
Power supply: 115 V/230 V–50/60 Hz
Max. power consumption: 250 VA

Accessories (included)

Power cord	1 pc	Option 10/11 Test lead red/black	2 pcs
Operation manual	1 pc	Option 40 Cable adapter for internal meter (M140/142)	1 pc
Test report	1 pc	Option 60 Cable adapter for four-wire resistances (M140/142)	1 pc
Spare fuse	2 pcs	Option 70 Cable adapter for four-wire resistances (M140/142)	1 pc
RS232 cable	1 pcs	Option 80 Cable adapter for low voltage measurement (M142)	1 pc

Available extra ordered options / Applied with model

Option 140-01 Cable adapter with built-in Pt temperature sensor	M140/142
Option 140-41 Cable adapter for simultaneous calibrations	M140
Option 10 Test lead 1m red, 1000 V/30 A	M140/140i/142/142i
Option 11 Test lead 1m black, 1000 V/30 A	M140/140i/142/142i-
Option 20 Test cable BNC-BNC	M140/142
Option 30 Test cable BNC-Banana	M140/142
Option 90 Pt100 external temperature sensor	M142
Option 100 Terminal adapter	M140/140i/142/142i
Option 140-50 Current coil x25/50	M140/140i/142/142i
GPIB Cable 2 m	M140/142
WinQbase / CALIBER Application SW	M140/140i/142/142i

Options and Accessories

Option 140-01 Cable Adapter for M-140 / M-142 models

140-01 cable adapter is designed for easy connection of unit under test to M-140/M-142 multifunction calibrator. Basic part of the adapter is metal working pad with integrated voltage and current outputs with banana ends.
The adapter is connected to the calibrator via front panel AUXILIARY connector and main output etrminals. On bottom side it contains mounted Pt100 temperature sensor through which ambient temperature is measured and value is applied for automatic compensation of cold junction temperature of simulated thermocouples.

Application:	multimeter, ammeter, voltmeter calibration
Dimensions:	230mm x 75mm x 290mm
Weight:	1 kg
Connection:	safety Ø 4mm banana

Option 140-41 Cable Adapter for M-140 model

Cable adapter Option 140-41 is especially suitable for process and simultaneous calibrations. It enables to apply all input and output functions of the M-140 multifunction Calibrator with output/input located on the AUXILIARY output connector on the calibrator front panel. Typical application is calibration and testing of such meters and transducers that need simulation of temperature sensors on the input side and measuring of output signal 20 mA/10V on the output side. When used in TESTER mode, additional relay contact of type PASS/FAIL is located on the adapter.

Application:	Strain gauge sensor measuring Voltage/Current/Resistance/Frequency measuring Simultaneous calibration and measurements
Dimensions / Weight:	105mm x 50mm x 170 mm / 0.5 kg

Option 10/11 Test Cable

Standard test cable black/red with length 1m dimensioned for signals to 1000 V and 32 A

Option 20 Test Cable

Standard test cable BNC–BNC length 1 m for calibration on frequency ranges.

Option 30 Test Cable

Standard test cable BNC–2 x Banana, length 1 m, for calibrations on frequency ranges.

Option 40 Cable Adapter

Cable adapter CANON 25–2 x Banana. With the adapter external source of signal can be measured with internal build-in multimeter. Option 40 enables measuring of DC voltage to 12 V, DC current to 25 mA, frequency to 15 kHz and temperature of TC temperature sensors.

Option 60 Cable Adapter

Cable adapter CANON 25–4 x Banana. Four terminal resistance measurement in build-in meter is accessible with the adapter. The option enables also direct measuring of ambient temperature via external RTD temperature sensors.

Option 70 Adapter

Cable adapter CANON 25–4 x Banana. Four-terminal output in resistance mode of M-140 is accessible with the adapter. Four-terminal output is more accurate than front panel output, especially for low resistance values.

Option 80 Cable Adapter (M142 only)

Using the adapter temperature of external termocouple sensors and mVDC to 2 V can be directly measured.

Option 90 External Temperature Sensor (M142 only)

Ambient temperature can be measured with Pt100 sensor directly.

Option 100 Terminal Adapter

Terminal adapter converts front panel terminal distance from 25 mm to ¾"

Option 140-50 Current Coil

25/50 turns current coil for calibration of clamp ammeters. Maximal range 1000 A.

Front/rear panel

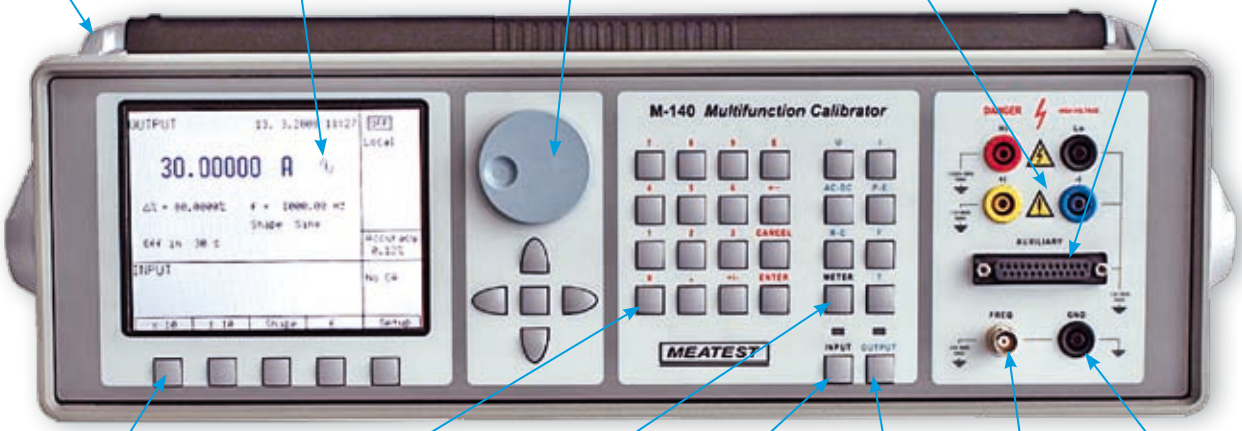
Multifunction colored display shows:
- status of the calibrator
- preset and measured values
- SETUP and Calibration menu
- calibration data
- local or remote control
- accuracy of the set value

Output terminals:
- AC/DC voltage/current
- AC/DC electric power/energy
- Resistance/Capacitance
- Sinusoidal & non-harmonic sinals

Low signal optional input/output:
- Cable adapters interface
- 4W resistance output
- built-in meter inputs
- ambient temperature sensing (Opt. 140-01)

Housing holder

Multifunction rotary button & cursor keys



Numerical keypad

Multimeter on/off input button with LED indicator

Frequency output to 20 MHz

Soft display keys

One-touch function buttons

Output on/off button with LED indicator

GND terminal protection earth

Power line entry module with:
* 115V/230V line voltage selector
* main power line fuse
* power line switch

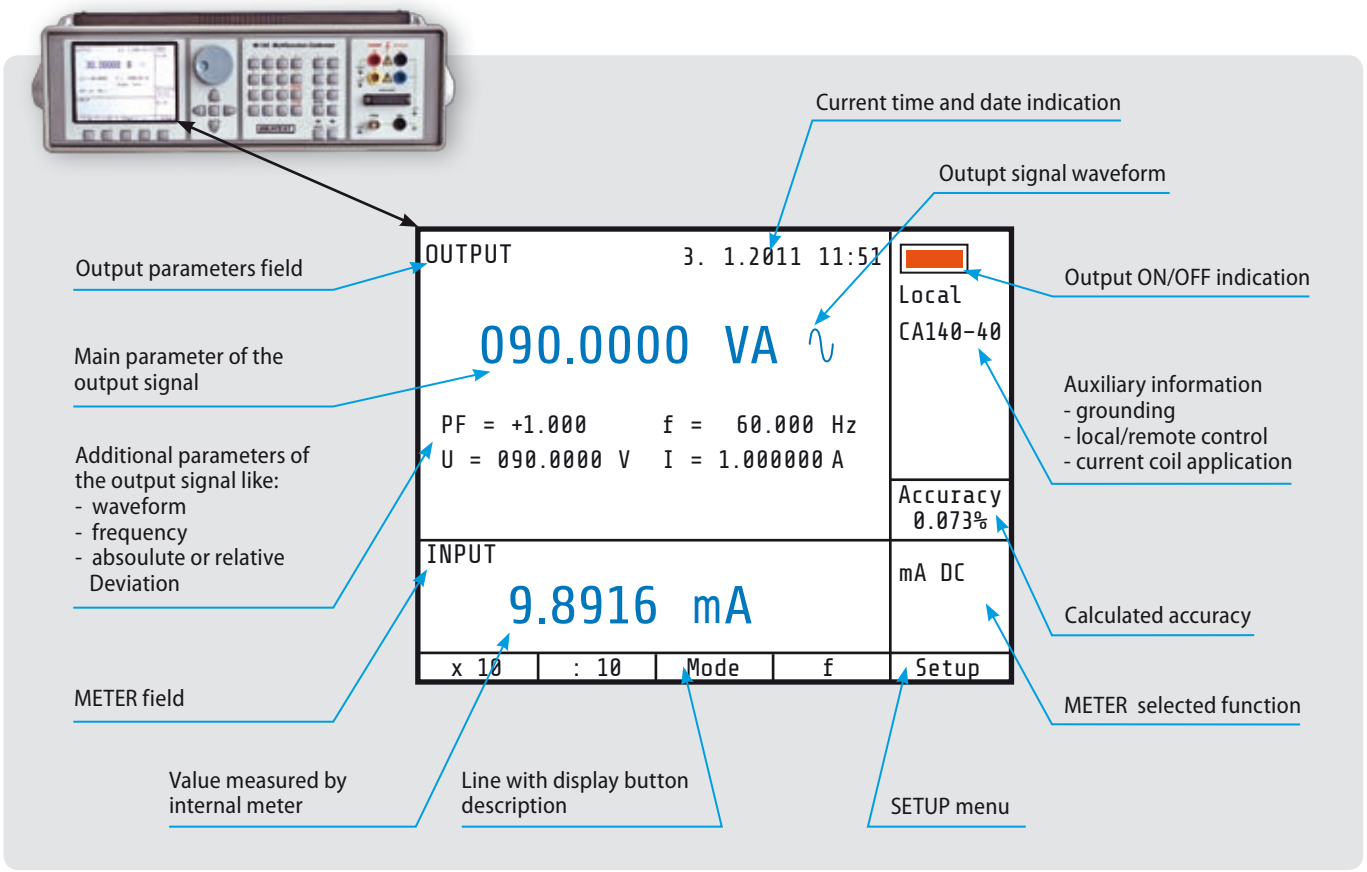
RS-232 interface

GPIB interface

Ventilation hole

Ventilation hole

Front panel display



Output terminals

Voltage output terminals H and L:
- DC output voltage 0 to 1000 V
- AC output voltage 100 uV to 1000 V
- Resistance in range 0 Ohmt to 50 MOhm (1000M in M-142)
- Capacitance in range 0.9 nF to 50 uF (100 uF in M-142)
- AC/DC voltage in power/energy mode
- Non-harmonic waveforms (triangle, square, saw)
- Square waveform with setable duty cycle ratio from 1 % to 99 %

Current output terminals +I and -I:
- DC output current from 0 uV to 20 A (30 A for M-142)
- AC output current 100 uA to 20 A (30 A for M-142)
- AC/DC current in power/energy mode

AUXILIARY connector

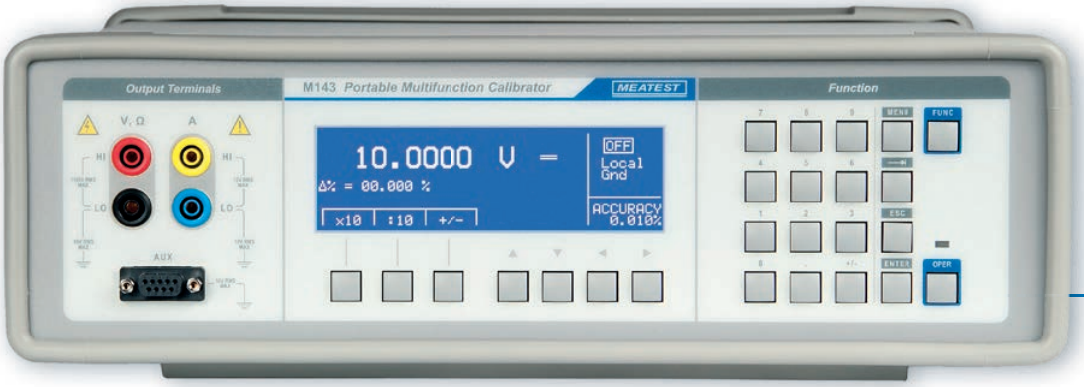
GND terminal
connected to protection earth

Frequency output:

- PWM mode
AC squarewave voltage with calibrated amplitude and duty cycle ratio from 1 mV to 10 V in frequency range from 0.1 Hz to 100 kHz

- HF mode
squarewave signal with calibrated amplitude 4Vpk-pk (0dB, -10dB, -20dB, -30dB) in frequency range from 0.1 Hz to 20 MHz

M143 / M143i Portable Multifunction Calibrator



1000 V and 20 A in such a small calibrator

M143

- DC/AC voltage up to 1000 V
- DC/AC current up to 20 A (2 A with M143i)
- Calibration of clamp meters up to 1000 A using Meatest 140–50 Current Coil
- Sinusoidal & Non-sinusoidal waveforms
- Fixed standard resistors from 10 Ω to 100 MΩ
- TC/RTD temperature sensor simulation
- Cold junction compensation using external Pt1000 sensor
- GPIB & RS232 interface
- Compact dimensions, overall weight 9 kg

M143/143i Multifunction calibrator is cost saving solution for calibration of meters of electric quantities up to 1000 V and 20 A. It offers basic accuracy 0.01 % in DC voltage needed for calibration of 3½ and 4½ digit multimeters. Resistance function is covered by eight fix resistors in range from 10 Ω to 100 MΩ. The calibrator offers TC temperature sensor simulation. It can be delivered optionally as well with RTD temperature sensor simulator. Thanks to its small dimensions and low weight the calibrator can be applied easily for field calibrations.

The calibrator main application field are production lines of panel meters, multimeters, transducers, measuring amplifiers, thermometers, and calibration laboratories where the calibrator can be applied as source of standard value for calibrations, verifications and adjustments of units under test.

Interface RS-232 and optionally GPIB interface bus enable automated operation in remote mode offering time saving automatic calibrations. Model M143/143i is fully compatible with Meatest calibration SW package CALIBER/WinQbase.

Specification

DC/AC SINE Wave Voltage

Voltage range summary: 0.0000 mV – 1000.00 VDC, 1.0000 mV – 1000.00 VAC
Resolution: 5½ digit
Wave form: sin, saw, triangle, square sym, truncated sin

Voltage accuracy

Range	*% of value + % of range*		
	DC	*20.000 Hz – 200.000 Hz*	*200.000 Hz – 2000.00 Hz*[*1]
0.0000 mV – 10.0000 mV[*2]	0.050 + 0.070	0.20 + 0.25	0.20 + 0.30
10.000 mV – 100.000 mV	0.010 + 0.0070	0.10 + 0.05	0.15 + 0.07
0.10000 V – 1.00000 V	0.006 + 0.0010	0.05 + 0.005	0.07 + 0.01
1.0000 V – 10.0000 V	0.006 + 0.0005		0.07 + 0.03
10.000 V – 100.000 V	0.006 + 0.0010	0.05 + 0.010	
100.00 V – 1000.00 V	0.010 + 0.0020	0.07 + 0.020	0.10 + 0.03

[*1] voltage ranges 100 and 1000V from 40 Hz to 1kHz
[*2] AC range starts at 1 mV

DC/AC SINE Wave Current

Current range summary : 0.000 µA – 20.000 ADC, 1.000 µA – 20.000 AAC (M143i version to 2A only)
Resolution: 5½ digit

Current accuracy

Range	*% of value + % of range*		
	DC	*20.000 Hz – 200.000 Hz*	*200.000 Hz – 1000.00 Hz*
0.000 µA – 200.000 µA *3	0.050 + 0.010	0.25 + 0.010	0.20 + 0.10
0.20000 mA – 2.00000 mA	0.025 + 0.005	0.10 + 0.010	0.10 + 0.02
2.0000 mA – 22.0000 mA	0.015 + 0.003	0.07 + 0.005	
22.000 mA – 200.000 mA			
0.2000 A – 2.0000 A	0.015 + 0.005	0.10 + 0.005	0.15 + 0.05
2.0000 A – 20.000 A *4 *5	0.1 + 0.01	0.20 + 0.015	0.25 + 0.05

*3 AC range starts at 1 µA
*4 continuous output ON in current range 10 A to 20 A is limited to 5 minutes max.
*5 20 A range in M143 model only

Resistance

Number of fix resistances: 8, 10 Ω to 100 MΩ Basic accuracy: 0.02 %

TC/RTD (optionally) Temperature Sensor Simulation

TC sensor types: R, S, B, J, T, E, K, N Basic accuracy: 0.1 °C
TC temperature simulation range: -250.0 °C to +1820.0 °C
RTD sensor types : Pt 1.385, Pt 1.392, Ni Basic accuracy: 0.2 °C to 2.7 °C
RTD temperature simulation range: -200.0 °C to +850.0 °C

Frequency Output

Waveform type: positive 5 V_{pk} Basic accuracy: 0.01 %
Frequency range : 0.100 0 Hz to 2.000 00 MHz

General information

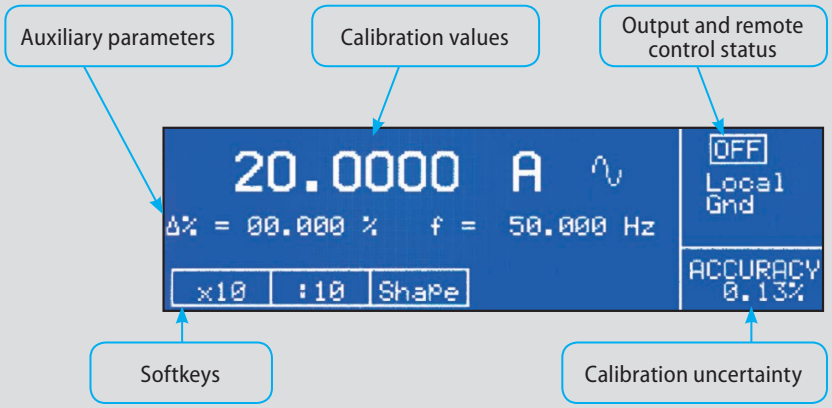
Interface: RS232, (IEEE488 as option)
Reference temperature: 21 … 25 °C
Operating temperature: 10 … 40 °C
Storage temperature: -10 … +55 °C
Power supply: 115/230 VAC, 50/60 Hz
Consumption: 250 VAC max
Dimensions: W 390 mm, H 128 mm, D 430 mm
Weight: 9 kg

Models:

M143	1000 V/20 A model with RS232
M143(i) RTD	model with built-in RTD simulator
M143i	1000 V/2 A model with RS232
M143(i) GPIB	model with RS232 and GPIB interface

Following information is displayed on the display:

- Set calibration value (V, A, Ω, °C)
- Auxiliary parameters (deviation, frequency, ...)
- Softkey function descriptions
- Output and remote control status
- Calibration uncertainty (%)



M-141 Portable Multifunction Calibrator

M-141

- AC/DC voltage to 750 V with 0.01 % accuracy
- AC/DC current to 2 A with 0.02 % accuracy
- Sinusoidal, square, triangle output signals
- Fix standard decimal resistors from 10 Ω to 100 MΩ
- Frequency output to 2 MHz
- TC temperature sensor simulation R, S, B, J, T, E, K, N in range from -250 °C to 1820 °C
- RTD temperature sensor simulator based on real resistor decade (optionally)
- Power supply voltage 115/230V 50/60 Hz
- Interface RS 232, IEEE488
- Comfortable control, large display

Portable multifunction calibrator is designed for use in calibration laboratories, quality departments and production lines as standard for electric quantity meters testing.
Low weight and small dimensions make easy field calibrations. With model M-141 calibration of voltmeters to 750 V, ammeters to 2 A, resistance ranges of multimeters and industrial evaluation units can be managed easily. External temperature sensor Pt1000 enables accurate automatic compensation of cold junction temperature when TC sensor is simulated.

Basic version is equipped with RS-232 interface, version M-141GPIB contains both RS232 and GPIB interfaces. Optionally, M-141R version is equipped with RTD simulator based on real physical resistors. Model M-141 is fully compatible to Meatest application SW WinQbase/CALIBER.

Voltage

Summary voltage range: 0 µV – 750 V DC, 1 mV – 750 V AC
Frequency range in AC mode: 20 Hz to 1 kHz in range 1mV to 10 V, 40 Hz to 1 kHz in range 10 V to 750 V
Accuracy of frequency: 0.01%

DC Voltage

Range	*% of value + % of range*
0 µV – 10 mV	0.05 + 0.005 + 10 µV
10 mV – 100 mV	0.01 + 0.001 + 10 µV
100 mV – 1 V	0.008 + 0.002
1 V – 10 V	0.008 + 0.002
10 V – 100 V	0.015 + 0.004
100 V – 750 V	0.018 + 0.004

AC Voltage

Range	*% of value + % of range*	*% of value + % z range*
	20 Hz – 200 Hz	*200 Hz – 2000 Hz*
1 mV – 10 mV	0.20 + 0.05 + 20 µV	0.20 + 0.10 + 20 µV
10 mV – 100 mV	0.10 + 0.03 + 20 µV	0.15 + 0.05 + 20 µV
100 mV – 1 V	0.05 + 0.005	0.07 + 0.01
1 V – 10 V	0.05 + 0.005	0.07 + 0.03
10 V – 100 V *1	0.05 + 0.010	0.07 + 0.03
100 V – 750 V *1	0.07 + 0.02	0.1 + 0.03

*1 Voltage ranges 100 and 700 V form 40 Hz to 1000 Hz

Current

Summary current range: 0 µA – 2 A DC, 1 µA – 2 A AC
Frequency range in AC mode: 20 Hz to 1 kHz

DC Current

Rrange	*% of value + % of range*
0 µA – 200 µA	0.05 + 0.0 + 20 nA
200 µA – 2 mA	0.025 + 0.005
2 mA – 22 mA	0.015 + 0.003
22 mA – 200 mA	0.015 + 0.003
200 mA – 2 A	0.015 + 0.005

AC Current

Range	*% of value + % of range*	*% of value + % of range*
	20 Hz – 200 Hz	*200 Hz – 1000 Hz*
1 µA – 200 µA	0.25 + 0.0 + 20 nA	0.30 + 0.10 + 20 nA
200 µA – 2 mA	0.10 + 0.01	0.20 + 0.05
2 mA – 20 mA	0.07 + 0.005	0.20 + 0.05
20 mA – 200 mA	0.07 + 0.005	0.20 + 0.05
200 mA – 2 A	0.1 + 0.005	0.25 + 0.05

Output waveform: sinus, triangle symmetrical, triangle A/B, square, limited sin (with defined distortion k=13.45%) from 1 mV to 10 V, frequency range 20 to 80 Hz

TC Temperature Sensor Simulation

Types: R, S, B, J, T, E, K, N

R	range [°C]	-50 – 0	0 – 400	400 – 1000	1000 – 1767
	accuracy [°C]	2.5	2.0	1.2	1.2
S	range [°C]	-50 – 0	0 – 250	250 – 1400	1400 – 1767
	accuracy [°C]	2.2	2.1	1.5	1.5
B	range [°C]	400 – 800	800 – 1000	1000 – 1500	1500 – 1820
	accuracy [°C]	2.7	1.5	1.4	1.3
J	range [°C]	-210 – -100	-100 – 150	150 – 700	700 – 1200
	accuracy [°C]	0.9	0.4	0.3	0.4
T	range [°C]	-200 – -100	-100 – 0	0 – 100	100 – 400
	accuracy [°C]	0.9	0.5	0.3	0.3
E	range [°C]	-250 – -100	-100 – 280	280 – 600	600 – 1000
	accuracy [°C]	1.7	0.3	0.2	0.3
K	range [°C]	-200 – -100	-100 – 480	480 – 1000	1000 – 1372
	accuracy [°C]	0.8	0.4	0.4	0.5
N	range [°C]	-200 – -100	-100 – 0	0 – 580	580 – 1300
	accuracy [°C]	1.3	0.6	0.6	0.5

RTD Temperature Sensor Simulation (Option)

Types: Pt, Ni Temperature scale: DIN, US/JIS

Temperature range	*Pt100-Pt200*	*Pt201-Pt1000*
-200 … 0 °C	0.2 °C	0.2 °C
0 … 850 °C	0.2 °C	0.2 °C

Temperature range	*Ni100-Ni200*	*Ni201-Ni1000*
-60 … 0 °C	0.2 °C	0.1 °C
0 … 300 °C	0.1 °C	0.1 °C

Resistance

Summary range: fix decimal values 10 Ω to 100 MΩ

Range	*Accuracy [%]*
10 Ω	0.03 + 10 mΩ
100 Ω	0.05
1 kΩ	0.02
10 kΩ	0.02
100 kΩ	0.02
1 MΩ	0.05
10 MΩ	0.05
100 MΩ	0.5

Frequency output

Waveform: square with fix amplitude 5Vpk-pk / 50 Ohm
Frequency range: 0.1 Hz to 2 MHz
Frequency resolution: 5 ½ digit
Accuracy: 0.005 %

General data

Weight:	8 kg
Dimensions:	325 mm x 111 mm x 316 mm
Interface:	RS232, IEEE488 (optionally)
Range of working temperatures:	+5 °C … +40 °C
Reference temperature range:	23 °C ± 2 °C
Power supply voltage:	115/230 V – 50/60 Hz

Options (extra ordered)

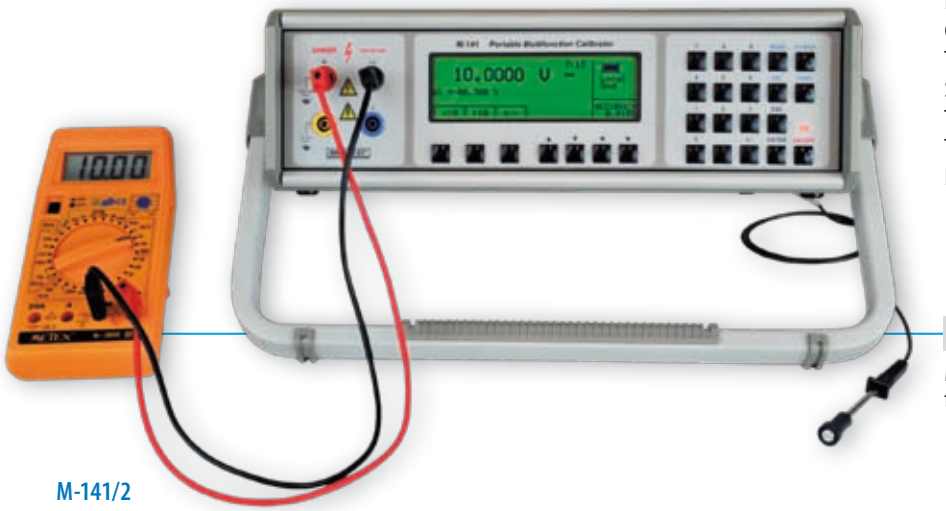
Option 140-50	Current coil 25/50 turns
Option 10	Test lead 1000 V/30 A (red)
Option 11	Test lead 1000 V/30 A (black)
Option GPIB	Cable GPIB IEEE488/IEEE488, 2 m
WinQbase/CALIBER	Application SW
Option 100 Terminal Adapter	2 pcs

Versions

M-141	basic model with RS232
M-141GPIB	RS232 and GPIB interface
M141R	with RTD simulator and RS232
M141R GPIB	with RTD simulator and GPIB/RS232

Accessory (included)

Power line cord	1 pc
Operation manual	1 pc
Test report	1 pc
Spare fuse	1 pc
Test lead 1000 V/20 A	2 pcs
Temperature sensor Pt1000	1 pc
RS232 Cable	1 ps



M-141/2

M-141

M141 is the sipmliest but powerful calibrator for calibration of meters of electric quantities.

M151 Current Calibrator

- Current 8 mA … 120 A (AC/DC)
- Frequency 15 Hz … 1 kHz
- Best accuracy 0.035 %
- Simulated current and transconductance amplifier
- Built-in process multimeter
- Output capability 8 Vpk
- RS232, IEEE488 (SCPI)

Model M151 is a stable high current calibrator up to 120 A. Basic accuracy is 0.035 %. Instrument can be controlled via RS232 or GPIB interface. Calibrator can work in a simulated amplifier mode to increase current ranges of any multifunction calibrator. It is suitable for power meter's calibration because M151 can be synchronized with the input signal not only in amplitude but also in frequency and phase. Current terminals are isolated up to 450 Vpk against case (protective earth).

M151 is a sophisticated instrument with its own recalibration procedure. The procedure enables to adjust any deviation directly from the front panel.

Calibrator is designed for checking parameters of amp meters. With current coil it can be used for calibration of clamp meters.

Specification

M151 Specification (1 year accuracy, reference temperature)

Range	*% of value + % of range*			*Maximal voltage*		
	DC	40 – 70 Hz	15 – 40 Hz 70 – 1000 Hz	DC	15 – 400 Hz	400 – 1000 Hz
0.008000 – 0.300000 A	0.025 + 0.01	0.025 + 0.01	0.03 + 0.02	8 V	5.5 V	3.5 V
0.30001 – 1.00000 A						
1.00001 – 2.00000 A						
2.00001 – 5.00000 A				5 V	3.5 V	
5.0001 – 10.0000 A	0.03 + 0.015	0.03 + 0.015	0.04 + 0.02			
10.0001 – 30.0000 A	0.035 + 0.015	0.035 + 0.015	0.05 + 0.02			
30.0001 – 60.0000 A						
60.0001 – 120.000 A						

Multimeter

Function	*Range*	*% of value + % of range*
AC voltage < 1 kHz	0 – 20 V	0.02 % + 0.02 %
AC voltage > 1 kHz		0.05 % + 0.05 %
DC voltage	±20 V	0.01 % + 0.01 %
AC current < 1 kHz	0 – 200 mA	0.02 % + 0.02 %
AC current > 1 kHz		0.05 % + 0.05 %
DC Current	±200 mA	0.01 % + 0.01 %
Frequency	1 Hz – 10 kHz	0.005 % + 0.00 %

General specification

Warm-up time:	15 min
Output terminals isolation:	up to 450 Vpk against GND (protective earth)
Distortion of output signal:	< 0.1 %
Frequency accuracy:	0.005 %
Frequency resolution:	0.001 Hz below 500 Hz 0.01 Hz above 500 Hz
Frequency synchronization:	internal, external, power supply
Simulated amplifier gain:	0.5 … 10 A/V (transconductance amplifier) 50 … 1000 A/A (current amplifier)
Remote control:	RS232, IEEE488 (SCPI)
Power supply:	115/230 VAC, 50/60 Hz
Reference temperatures:	+ 20 °C … + 26 °C
Working temperatures:	+ 5 °C … + 40 °C
Storage temperatures:	- 10 °C … + 55 °C
Dimensions:	W 538 mm, H 283 mm, D 540 mm
Weight:	42 kg

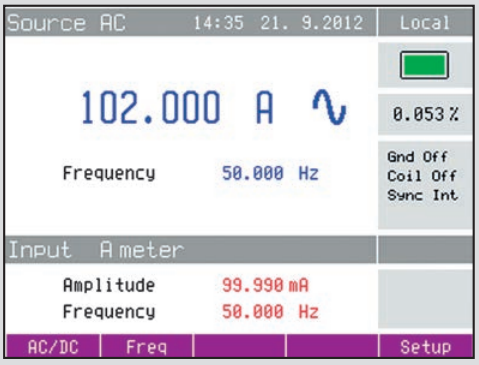
Content of delivery

Current Calibrator M151
Cable RS 232
User's manual
Power supply cable

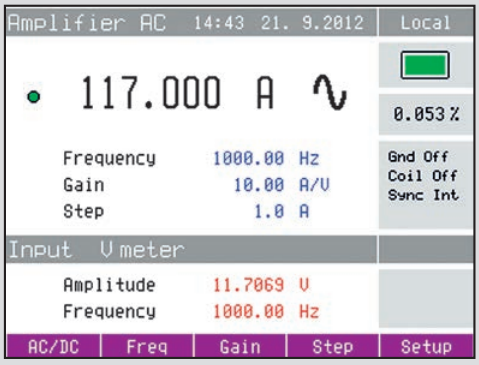
Options (extra ordered)

Option 151-25	25 turns current coil
IEEE488/IEEE488	GPIB cable 2 m
Caliber	SW for calibration of meters

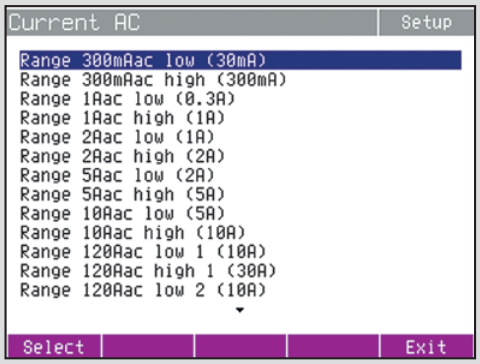
AC current source



Simulated transconductance amplifier



Recalibration



Models & Features

M133 / M133i Single phase calibrators

Both models

- AC voltage 1 … 600 V
- DC voltage 1 … 280 V
- AC/DC current 8 mA … 30 A
- Frequency DC, 15 … 1000 Hz
- Phase 0 … 360°
- AC power 0 … 18 kVA
- DC power 0 … 8.4 kW
- AC/DC energy
- Built in process multimeter
- RS232, IEEE488 (SCPI), Ethernet
- Can be extended up to 3 phase system

M133 only

- Harmonic / interharmonic distortion
- Modulation and flicker
- Dip/Swell

M133C / M133Ci Three phase calibrators

Both models

- AC voltage 1 … 600V
- DC voltage 1 … 280V
- AC/DC current 8mA … 30A (90A single phase)
- Current outputs floating up to 450Vpk
- Frequency DC, 15 … 1000Hz
- Phase 0 … 360°
- AC power 0 … 54kVA
- DC power 0 … 25.2kW
- AC/DC energy
- Built in process multimeter
- RS232, IEEE488 (SCPI), Ethernet

M133C only

- Harmonic / interharmonic distortion
- Modulation and flicker
- Dip/Swell

Basic feature of the device is precise simulation of DC and AC electric power and energy in voltage range to 280Vdc (600Vac) and in current range to 30 A. In AC electric power mode phase shift between voltage and current channel can be set in range 0° to 360°.
Best accuracy of simulation is 0.02°. Calibrator offers high burden current of voltage output of several hundreds mA and compliance voltage of current output up to 5Vrms. Current range can be extended using Option 140-50 50 turns current coil up to 1500 A.
M133 and M133C calibrators are equipped with special functions for power line voltage analyzers testing (qualimeters). It can generate calibrated harmonic and interharmonic distortion, fluctuation harmonics, flickers, ramp signals, dips, swells and others. User interface offers simple and user convenient programming of output signal parameters.
M133i and M133Ci calibrators are delivered without the option of harmonic/interharmonic functions.

Specification

DC/AC voltage sinus

Voltage range: 1 Vdc to 280 Vdc, 1 Vac to 600 Vac
Resolution: 5½ dig.
Frequency range: DC, 15 Hz to 1000 Hz.
Synchronization to mains frequency or external signal is available.

Frequency accuracy: 0.005 %
Frequency resolution: 0.001 Hz bellow 500 Hz, 0.01 Hz above 500 Hz
Distortion of output signal: < 0.05 %

Range	*% of value + % of range*	*Max. burden (mA)*	*% of value + % of range*	*Max. burden (mA)*	*% of value + % of range*	*Max. burden * (mA)*
	DC	*DC*	*15 – 40 Hz 70 – 1000 Hz*	*15 – 40 Hz 70 – 1000 Hz*	*40 – 70 Hz*	*40 – 70 Hz*
1.0000 – 10.0000 V	0.015 + 0.01	100	0.02 + 0.01	100	0.015 + 0.01	100
10.0001 – 30.0000 V	0.015 + 0.01	200	0.02 + 0.01	200	0.015 + 0.01	200
30.001 – 70.000 V	0.015 + 0.01	200	0.02 + 0.01	200	0.015 + 0.01	300
70.001 – 140.000 V	0.015 + 0.01	200	0.02 + 0.01	200	0.015 + 0.01	300
140.001 – 280.000 V	0.015 + 0.01	150	0.02 + 0.01	150	0.015 + 0.01	200
280.001 – 600.000 V**	—	—	0.03 + 0.01	50	0.02 + 0.01	60

* Sum of all currents (three phases) for M133C (M133Ci) is limited to 400 mA
** Only fundamental harmonic in range over 280 Vac, frequency range 20 – 1000 Hz

DC/AC current sinus

Current range: 0.008 A to 30 A
Resolution: 5½ dig.
Frequency range: DC, 15 Hz to 1000 Hz.
Synchronization to mains frequency or external signal is available.

Frequency accuracy: 0.005 %
Frequency resolution: 0.001 Hz bellow 500 Hz, 0.01 Hz above 500 Hz
Distortion of output signal: < 0.1 %

Range	*% of value + % of range*	*Max. voltage (V)*	*% of value + % of range*	*% of value + % of range*	*Max. voltage (V)*	*Max. voltage (V)*
	DC	*DC*	*15 – 40 Hz 70 – 1000 Hz*	*40 – 70 Hz*	*15 – 400 Hz*	*400 – 1000 Hz*
0.008000 – 0.300000 A	0.025 + 0.01	8	0.03 + 0.02	0.025 + 0.01	5.5	3.5
0.30001 – 1.00000 A	0.025 + 0.01	8	0.03 + 0.02	0.025 + 0.01	5.5	3.5
1.00001 – 2.00000 A	0.025 + 0.01	8	0.03 + 0.02	0.025 + 0.01	5.5	3.5
2.00001 – 5.00000 A	0.025 + 0.01	5	0.03 + 0.02	0.025 + 0.01	3.5	3.5
5.0001 – 10.0000 A	0.03 + 0.015	5	0.04 + 0.02	0.03 + 0.015	3.5	3.5
10.0001 – 30.0000 A	0.035 + 0.015	5	0.05 + 0.02	0.035 + 0.015	3.5	3.5

Additional uncertainty with applied current coil Opt.140-50 is 0.3 %. Output current is multiplied by factor 50.

Phase shift voltage/current – Power factor

Phase shift range: 0.00° to +359.99°
Frequency range: 15 Hz to 1000 Hz
Phase shift resolution: 0.01°
Power factor range: -1 to +1
Power factor resolution: 0.001
Power factor accuracy: $dPF = 100*(1 - \cos(\varphi+d\varphi)/\cos\varphi)$ (%)

Phase shift accuracy φ (internal synchronization)

Frequency (Hz)	*Current (A)*	*Accuracy φ (°)*
15 – 70	0.008 – 0.1	0.05
15 – 70	0.1 – 10	0.02
15 – 70	10 – 30	0.05
70 – 400	0.008 – 30	0.1
400 – 1000	0.008 – 30	0.4

DC electric power

Total range: 0.008 W to 8400 W (420 kW with current coil option 140–50)
Quantity: W

*DC electric power accuracy (%) **					
Current range	Voltage range				
	1 V – 10 V	*10 V – 30 V*	*30 V – 70 V*	*70 V – 140 V*	*140 V – 280 V*
8 mA – 5 A	0.044	0.044	0.044	0.044	0.044
5 A – 10 A	0.05	0.05	0.05	0.05	0.05
10 A – 30 A	0.06	0.06	0.06	0.06	0.06

* Best accuracy is shown.

AC electric power *

Total range: 3x (0.008 VA to 18 kVA (900 kVA with current coil option 140–50)

Frequency range: 15 Hz to 1000 Hz
Quantity: W, VA, VAr

AC electric power accuracy (%) for PF = 1.0 f = 40 – 70 Hz						
Current range	Voltage range					
	1 V - 10 V	*10 V - 30 V*	*30 V - 70 V*	*70 V - 140 V*	*140 V – 280 V*	*280 V – 600 V*
8mA –100mA	0.06	0.06	0.06	0.06	0.06	0.06
100mA –5 A	0.04	0.04	0.04	0.04	0.04	0.05
5 A – 10 A	0.05	0.05	0.05	0.05	0.05	0.06
10 A - 30 A	0.06	0.06	0.06	0.06	0.06	0.06
AC electric power accuracy (%) for PF = 0.8 f = 40 – 70 Hz						
Current range	Voltage range					
	1 V - 10 V	*10 V - 30 V*	*30 V - 70 V*	*70 V - 140 V*	*140 V – 280 V*	*280 V – 600 V*
8mA –100mA	0.09	0.09	0.09	0.09	0.09	0.09
100mA –5 A	0.05	0.05	0.05	0.05	0.05	0.05
5 A – 10 A	0.06	0.06	0.06	0.06	0.06	0.06
10 A - 30 A	0.09	0.09	0.09	0.09	0.09	0.09
AC electric power accuracy (%) for PF = 0.5 f = 40 – 70 Hz						
Current range	Voltage range					
	1 V - 10 V	*10 V - 30 V*	*30 V - 70 V*	*70 V - 140 V*	*1 V - 10 V*	*280 V – 600 V*
8mA –100mA	0.16	0.16	0.16	0.16	0.16	0.16
100mA –5 A	0.08	0.08	0.08	0.08	0.08	0.08
5 A – 10 A	0.08	0.08	0.08	0.08	0.08	0.08
10 A - 30 A	0.16	0.16	0.16	0.16	0.16	0.16

* Best accuracy for active power.

Electric power accuracy is calculated according to formula: $dP = \sqrt{(dU^2 + dI^2 + dPF^2 + 0.012)}$ (%)

DC/AC electric energy

Voltage range: 1 V to 280 Vdc (600 Vac)
Current range: 0.008 A to 30 A
Power factor range: - 1 to + 1

Time interval setting: 1 s to 10 000 s
Time interval resolution: 0.1 s
Time interval accuracy: 0.01% + 0.1s

Non-harmonic signals (models M133 and M133C only)

Modulation, Flicker

Fundamental harmonic frequency range: 15 Hz to 1 kHz
Single harmonic (2–50) frequency range: 30 Hz to 5 kHz
Modulation frequency range: 0.001 Hz to 50 Hz
Modulation depth: 0 to 30 %
Modulation depth resolution: 0.001 %
RMS amplitude uncertainty: 0.2 % of range
Waveform of modulation signal: sinus, rectangular
Duty cycle ratio of rectangular signal: 1 % to 99 %
Modulation depth accuracy: 0.2 %

Harmonic and interharmonic distortion (H/I products)

Fundamental harmonic frequency range:	15 Hz to 1 kHz
Fundamental harmonic uncertainty:	0.2 % of range
Frequency range of harmonic products:	30 Hz to 5 kHz
Frequency range of interharmonic product:	15 Hz to 1 kHz
Max. number of harmonic products:	50
Number of interharmonic products:	1
Frequency uncertainty:	0.005 %
H/I products amplitude range:	max. 30 % of RMS output value
Amplitude resolution of H/I products:	0.001 %
Noise & distortion:	- 60 dB

Accuracy of H/I products amplitude

Ranges	*% of range*	*% of range*
	30 – 3000 Hz	*3000 - 5000 Hz*
1.0000 – 10.0000 V 10.0001 – 30.0000 V 30.001 – 70.000 V 70.001 – 140.000 V 140.001 – 280.000 V	0.1	0.2
0.008000 – 0.300000 A 0.30001 – 1.00000 A 1.00001 – 2.00000 A	0.1	0.2
2.00001 – 5.00000 A 5.0001 – 10.0000 A	0.2	0.4
10.0001 – 30.0000 A	0.2	0.8

Dip/Swell

AC voltage range:	0.1 V … 280 V
AC current range:	1 mA … 30 A
Amplitude accuracy:	0.2 % of range *1
Frequency range:	15 Hz … 1 kHz

*1 Range is defined according to the highest level of generated signal.
*2 t1 + t5 > 2 ms

Timing *2

t1 range:	0 s … 60 s
t2 range:	0.1 ms … 60 s
t3 range:	2 ms … 60 s
t4 range:	0.1 ms … 60 s
t5 range:	0 s … 60 s

Built in process multimeter

Function	*Range*	*Accuracy*	*Resolution*
DC voltage	0 to ±12 V	0.01 % + 0.01 %	100µV
DC current	0 to ±25 mA	0.01 % + 0.01 %	100 nA
Frequency	1 Hz to 15 kHz	0.005 %	10 µHz – 0.1 Hz

Specification includes long-term stability, temperature coefficient, linearity, load and line regulation and the traceability of factory and National calibration standards. Specified accuracy is valid after one hour warm up in temperature range 23 ± 2 °C. Specified accuracy is one year accuracy.

General data

Warm up time:	60 min
Operating temperature:	23 ± 10 °C
Storage temperature:	-10 to 55 °C, humidity < 90 %
Reference temperature:	23 ± 2 °C
Power supply:	115/230V – 50/60 Hz
Safety class:	I, according EN 1010

M-133

Dimensions:	460 x 580 x 320 mm
Weight:	29 kg
Power consumption:	max. 550 VA

M-133C

Dimensions:	500 x 520 x 430 mm
Weight:	59 kg
Power consumption:	max. 1500 VA

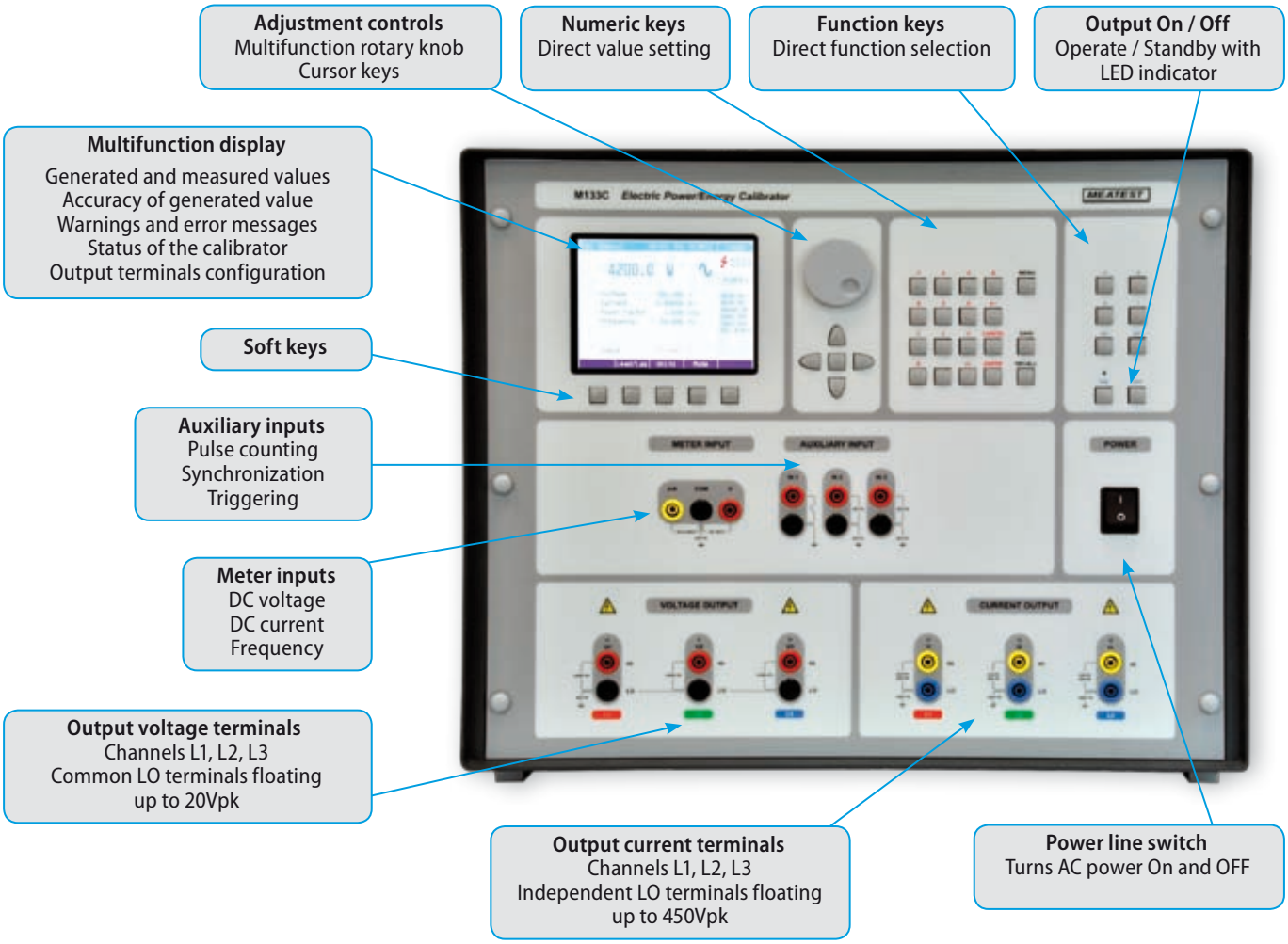
M133/M133C Basic accessories (included in delivery)

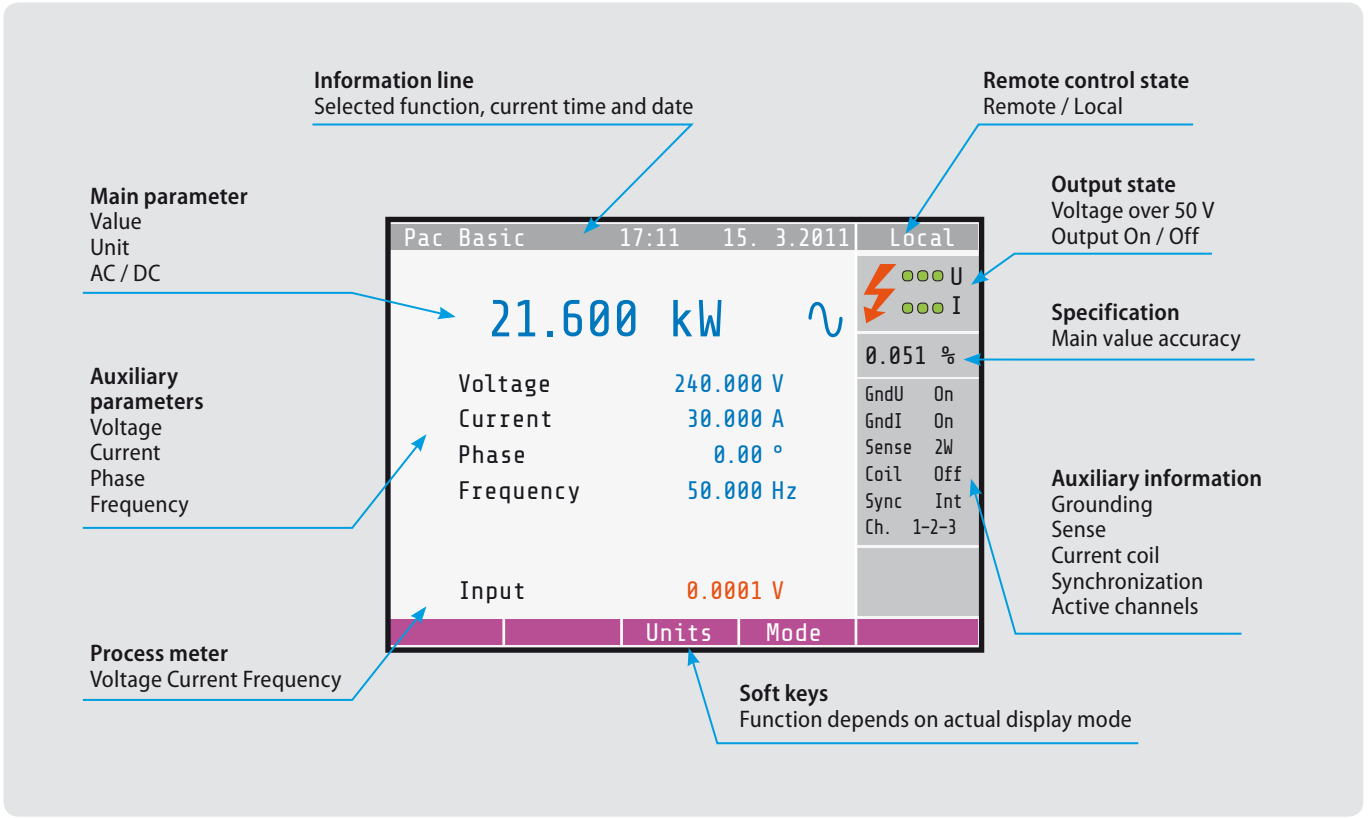
Power line cord	1 pc
User´s manual	1 pc
Test report	1 pc
Spare fuse	1 pc
RS-232 cable 1.5 m	1 pc
Test cables 1000V/32A, 1 m	4 pcs/M133 12 pcs/M133C
M133C-01 High Current Adapter	1 pc/M133C

Options (extra ordered)

140-50	Current coil 25 and 50 turns
Option 10	Test cable 32 A/1000 V (black)
Option 11	Test cable 32 A/1000 V (red)
Option 12	Test cable 32 A/1000 V (blue)
Option 13	Test cable 32 A/1000 V (yellow)
IEEE488/IEEE488	GPIB cable, 2 m
Caliber	Application SW for calibration of meters
Power	Application SW for transducers calibration

M133C front panel

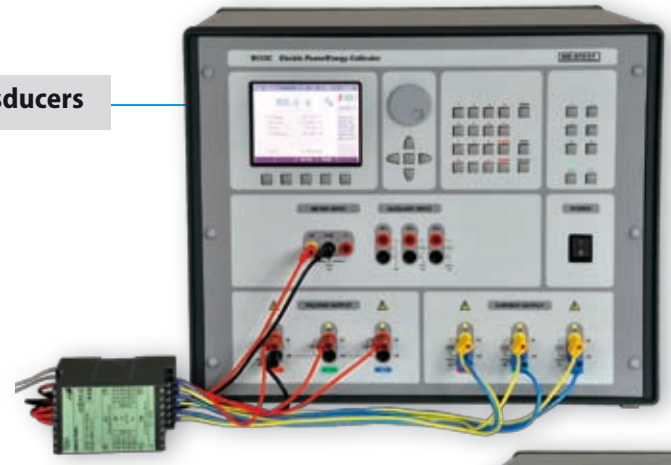




Application

Calibration of different transducers

INPUT	OUTPUT
power	+/- 10V
voltage	+/- 20mA
current	0…10 kHz
phase	
frequency	



Calibration of power quality meters (M133 / M133C only)

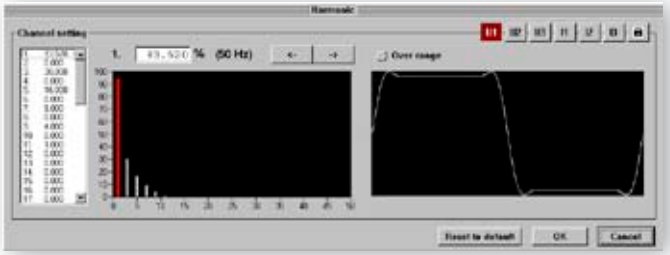
power	harmonic 1…50
voltage	interharmonic
current	modulation
phase	flicker
frequency	dip/swell

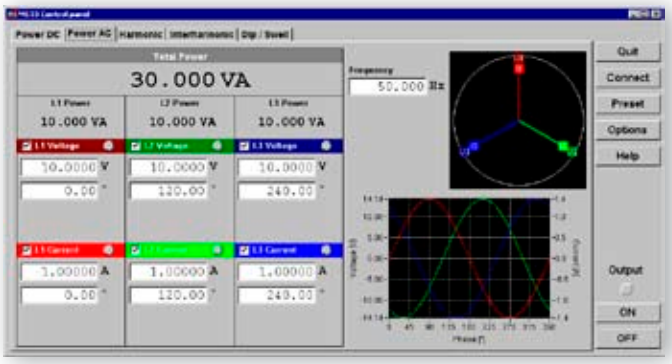
High current adapter Option M133C-01

- Direct current up to 90A
- Parallel connection of three current outputs
- Standard option for three phase system

M133 control panel (freeware)

Program can be used with all M133 models. All parameters are displayed in computer where can be also changed. Setting can be saved as a computer file. Program displays vector diagram and shapes of individual signals.



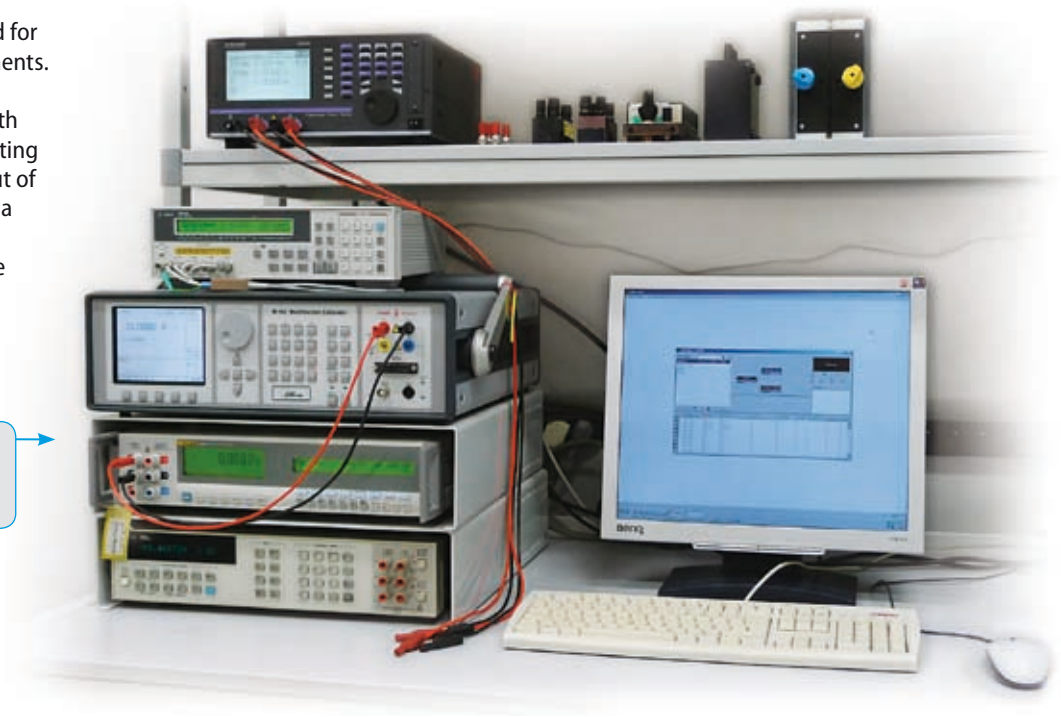


Free download from www.meatest.com

Caliber Software for automatic calibration of instruments

Determination

The CALIBER program is intended for automatic calibrations of instruments. Except of the unit under test and the standard unit, a computer with Windows 2000/XP/Vista/7 Operating System is being necessary. Output of the CALIBER program represents a physically performed calibration with a calibration record – a table with measured and evaluated values (the test report).

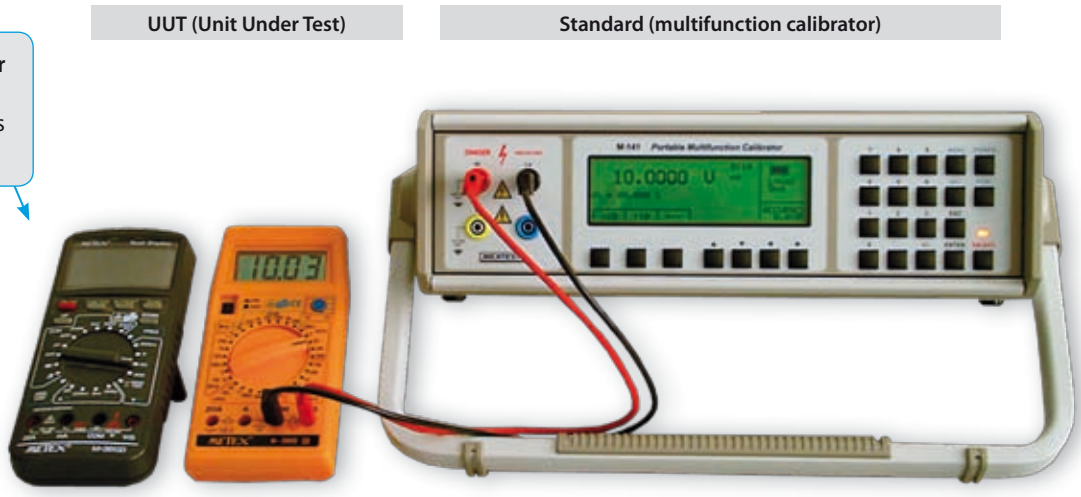


Typical workplace
Standard instruments controlled by the Caliber software

Basic features

- Easy creation of calibration procedures using Procedure wizard
- Automatic calibration of instruments
- Instruments control via RS232, IEEE488, USB, RS485, Ethernet (VISA)
- Suitable for various instruments (meters, sources, transducers)
- Calculated deviation and uncertainty in each point of test report
- Selectable rounding of measured and evaluated values
- Calibration uncertainty evaluated according to metrology standards
- Up to 20 instruments in one calibration point
- Windows 2000/XP/Vista/7 (32/64 bit)

Instruments prepared for calibration
"Standard unit" and "Units under test"



Program window description

Instruments scheme
Instruments used in selected calibration point and their configuration

Information line
Description of performed operation

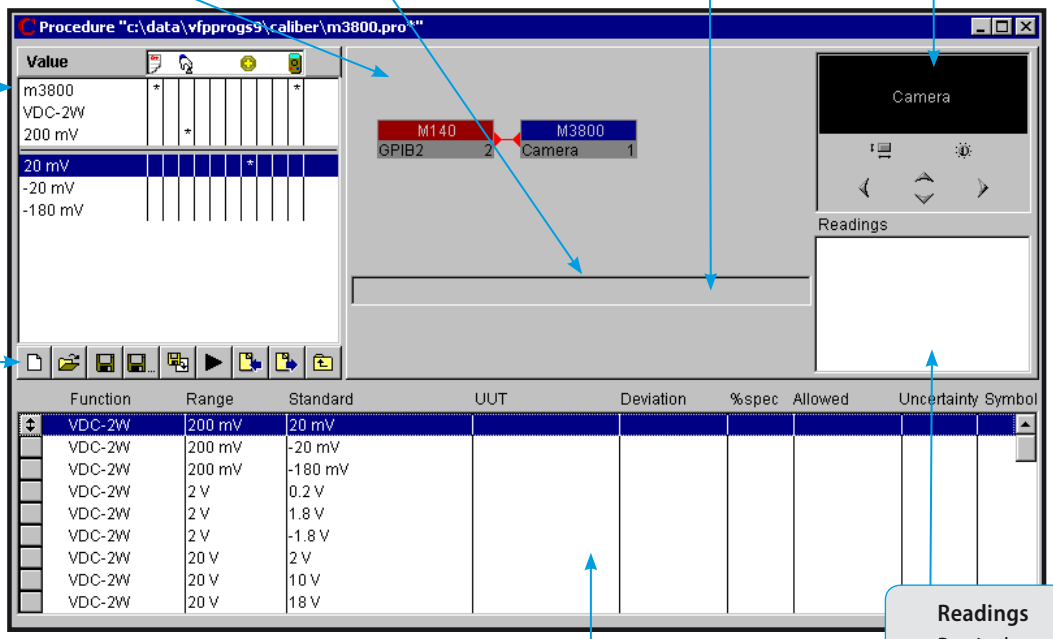
User prompt window
Program messages

Set function and range manually
M3800 Function VDC-2W Range 20 V

Camera
Optional camera module for digital display scanning

Status window
Functions
Ranges
Points
Active terminals connection
Exceptions

Direct keys
New / Open /Save
Reload Start
Calibration
Import / Export



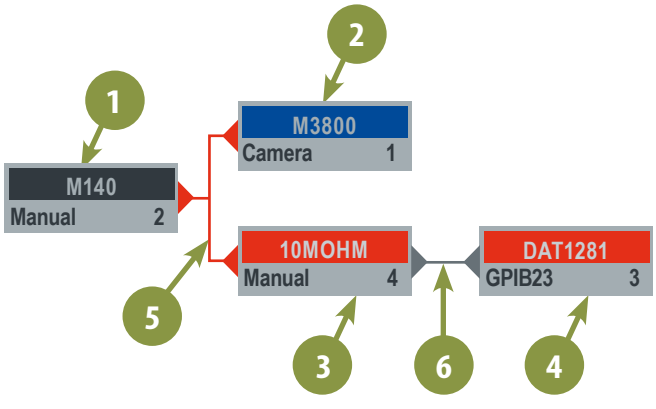
Readings
Particular measured values

Test report
Measured and evaluated values (measured deviation, maximum allowed deviation, measurement uncertainty)
Values are added during the calibration.

Function	Range	Standard	UUT	Deviation	%spe	Allowed	Uncert.	
VDC-2W	200 mV	20.0 mV	20.0 mV	-0 uV	0	200 uV	62 uV	ok
VDC-2W	200 mV	180.0 mV	180.6 mV	620 uV	62	1003 uV	71 uV	ok
VDC-2W	200 mV	-180.0 mV	-180.7 mV	-690 uV	-69	1003 uV	69 uV	ok
VDC-2W	2 V	0.200 V	0.200 V	-0.00 mV	0	2.00 mV	0.58 mV	ok
VDC-2W	2 V	1.800 V	1.807 V	7.00 mV	70	10.04 mV	0.58 mV	ok
VDC-2W	2 V	-1.800 V	-1.807 V	-6.80 mV	-68	10.03 mV	0.64 mV	ok
…								

Instruments scheme

Program uses special symbols for displaying different types of instruments in the “Instruments scheme” diagram. Up to 20 instruments can be used in one calibration point.



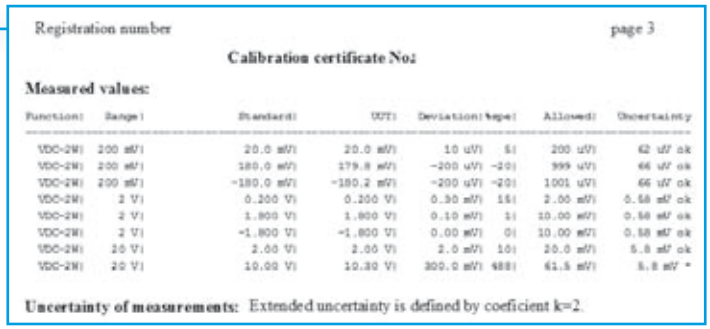
1. Source
2. UUT (meter)
3. Standard converter
4. Standard (meter)
5. Master signal bus
6. Transformed bus

Remote control

The instruments can be operated either manually or automatically (by computer). In automatic mode the interface RS232 or GPIB can be used, eventually any other interfaces (USB, Ethernet, RS485, …) which utilize the industry VISA standard.

Caliber output

Output of the CALIBER program represents a physically performed calibration with a calibration record – a table with measured and evaluated data (the test report).

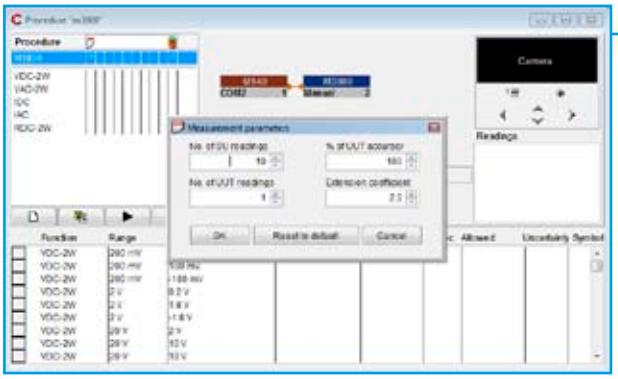

Registration number page 3

Calibration certificate No:

Measured values:

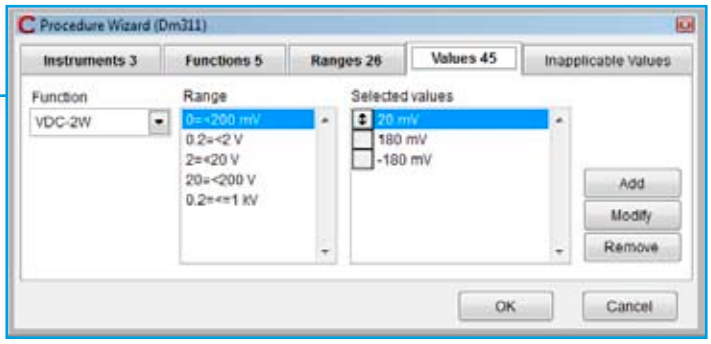
Function	Range	Standard	UUT	Deviation	%ge	Allowed	Uncertainty
VDC-2W	200 mV	20.0 mV	20.0 mV	10 uV	5	200 uV	62 uV ok
VDC-2W	200 mV	180.0 mV	179.8 mV	-200 uV	-20	999 uV	66 uV ok
VDC-2W	200 mV	-180.0 mV	-180.2 mV	-200 uV	-20	1001 uV	66 uV ok
VDC-2W	2 V	0.200 V	0.200 V	0.30 mV	15	2.00 mV	0.58 mV ok
VDC-2W	2 V	1.800 V	1.800 V	0.10 mV	1	10.00 mV	0.58 mV ok
VDC-2W	2 V	-1.800 V	-1.800 V	0.00 mV	0	10.00 mV	0.58 mV ok
VDC-2W	20 V	2.00 V	2.00 V	2.0 mV	10	20.0 mV	5.8 mV ok
VDC-2W	20 V	10.00 V	10.30 V	300.0 mV	688	61.5 mV	5.8 mV *

Uncertainty of measurements: Extended uncertainty is defined by coeficient k=2.



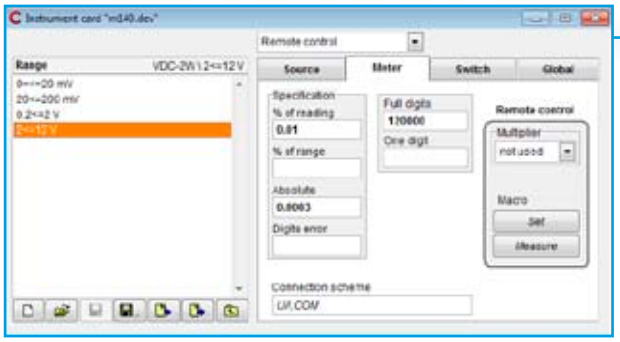
Calibration procedure

Automatic calibration of UUTs is controlled through Calibration procedure. Calibration procedure is list of calibration points in that order, how they will be executed during calibration. Calibration procedure is different for different types of UUT. Calibration procedures for various UUT can be created direct in CALIBER program. For running, creating and modifying of calibration procedures, program module "Procedures" is aimed. Calibration procedure can be prepared in program CALIBER only.



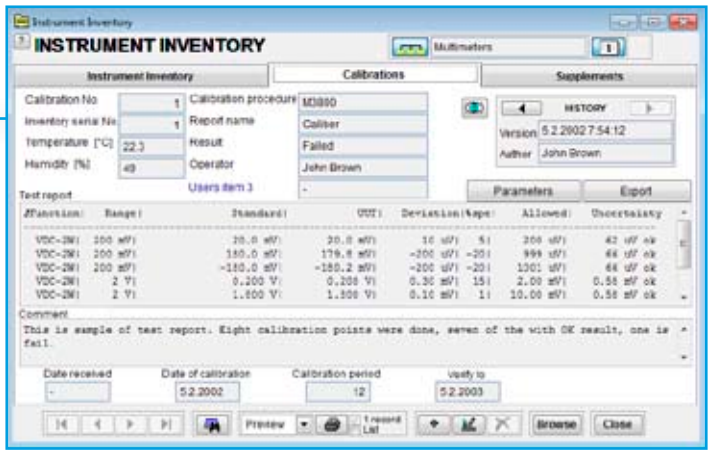
Procedure wizard

Procedure wizard serves for convenient and easy preparing of new Calibration procedures. In general, "Instrument cards" determines action of the instruments which are connected to the calibration system. "Calibration procedures" define procedure of the calibration, point by point. All basic program modules are created in interactive way. Its generation doesn't require knowledge of programming.



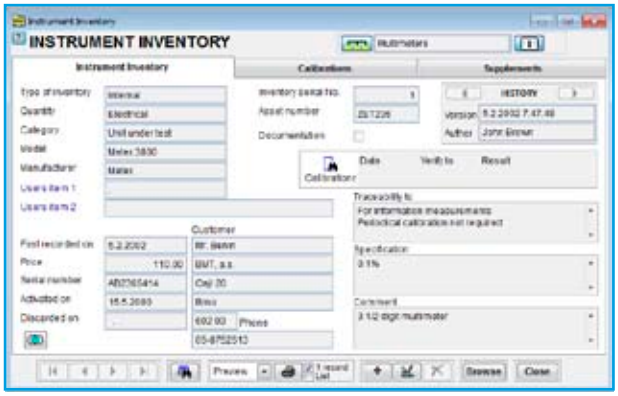
Instrument card

Instrument card contains description of metrological features of an instrument (functions, ranges, specification etc.) and way of instrument control (GPIB, RS232 or VISA remote control commands). Instrument without instrument card can't be used in calibration procedure. For creating and editing of instrument cards program module "Instrument card" is prepared.



WinQbase-Caliber

Caliber can be used either independently or as a part of database software package WinQbase. WinQbase is program for keeping records of various types of measuring instruments. It can be used as a program superstructure of the Caliber system. It provides identification of measuring instruments, of calibration sheets, record print, measuring instrument selection according to diverse criteria etc.

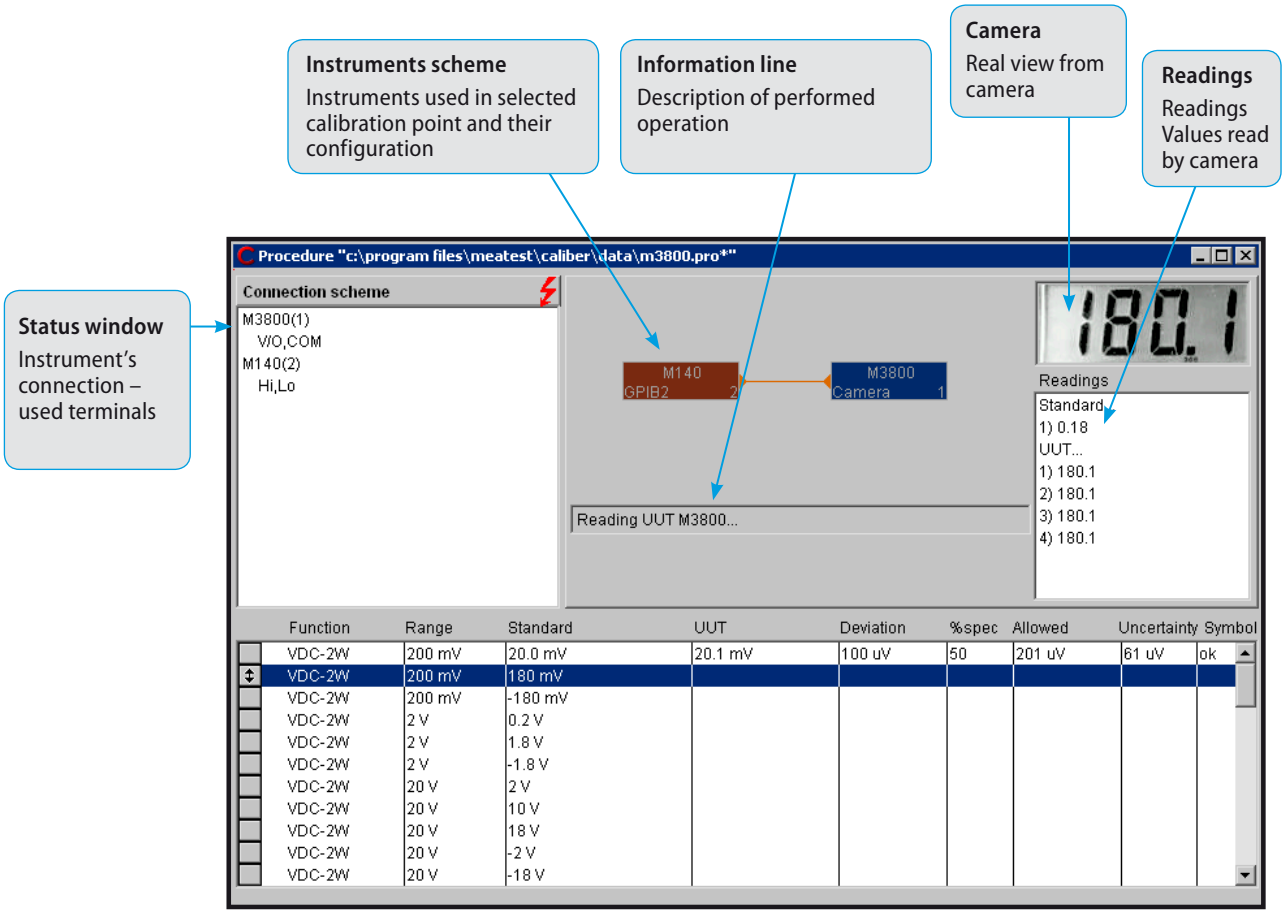


Caliber program is specialized for automatic calibration of instruments. Standard delivery contains functions for electrical quantity meters calibration. New functions for non-electric quantities can be defined by user and appropriate calibration procedures can be generated.

CamOCR (optional Camera module)

CamOcr camera module extends possibilities of MEATEST automatic calibration software Caliber. CamOcr is designed for scanning of 7 segment digital displays.

Instruments (UUT) without remote control interface can be “connected” using CamOcr to the computer. Instrument’s display is scanned by digital video camera. CamOcr converts scanned pictures into numbers. These numbers (measuring results) are used in for further calculations. It is very easy to do repeated measurements and calculate uncertainty type “A” for every calibration point.



M63x / M64x Resistance Decades and RTD Simulators

- Resistance range up to 100 mΩ – 20 MΩ
- Operating voltage 200 V
- Simulation of RTD temperature sensors
- User defined curves (conversion tables)
- Fully programmable via RS232 (optionally USB, IEEE488, LAN)

M632

	Usage	*Range*	*Resolution*	*Max. load*	*Interfaces (RS232 std.)*	*Accuracy*
M632	Resistance Decade	1 Ω – 1.2 MΩ	10 μΩ	0.25 W	USB, GPIB, LAN	0.003 %
M642		0.1 Ω – 20 MΩ	1 μΩ	5 W		0.02 %
M631	RTD Simulator	16 Ω – 400 kΩ	0.001 °C	0.25 W		0.01°C
M641		10 Ω – 300 kΩ	0.01 °C	5 W		0.1°C

The new M6xx series programmable resistance decades and RTD simulators offer an exceptional accuracy, resolution and stability of real resistance simulation. Both M63x decades contain stable foil resistors with low temperature coefficient switched by low thermal voltage relays. Built-in software has also a function of RTD temperature sensor simulation with parameters according to IEC (DIN) or US standards and temperature setting in degree of Celsius or Fahrenheit. Instrument can be controlled via RS232, USB, LAN or GPIB interface.
M6xx series programmable decades are sophisticated instruments with their own recalibration procedures. The procedure lets the user to correct any deviation in resistance without any mechanical adjusting.
Decade box is designed for checking parameters of resistance meters, regulators and process meters that use external resistance sensors for non-electric quantity measuring.

Specification

M632 Resistance accuracy

Range / Resolution	*Accuracy*
1.000 00 Ω – 2.000 00 Ω	0.002 % + 2 mΩ
2.000 1 Ω – 20.000 0 Ω	
20.001 Ω – 200.000 Ω	
200.01 Ω – 2000.00 Ω	0.003 %
2.000 1 kΩ – 20.000 0 kΩ	
20.001 kΩ – 200.000 kΩ	
200.01 kΩ – 1200.00 kΩ	0.005 %

M631 Resistance accuracy

Range / Resolution	*Accuracy*
16.000 0 Ω – 20.000 0 Ω	0.002 % + 2 mΩ
20.001 Ω – 200.000 Ω	
200.01 Ω – 1000.00 Ω	0.003 %
1000.1 Ω – 3000.0 Ω	0.005 %
3001 Ω – 10000 Ω	0.015 %
10.01 kΩ – 30.00 kΩ	0.03 %
30.1 kΩ – 100.0 kΩ	0.1 %
101 kΩ – 400 kΩ	0.4 %

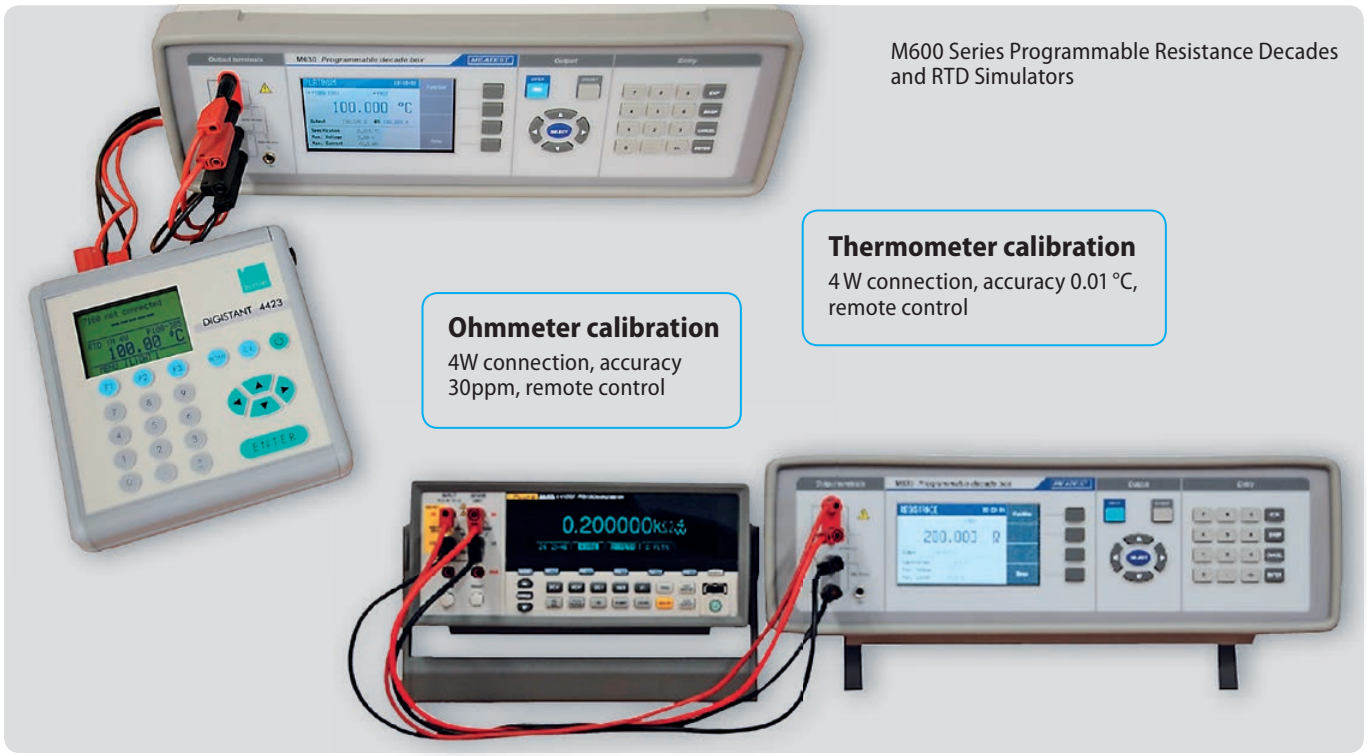
M642 Resistance accuracy

Range / Resolution	*Accuracy*
100.000 mΩ – 200.000 mΩ	0.05 % + 15 mΩ
200.01 mΩ – 2.00000 Ω	
2.0001 Ω – 20.0000 Ω	
20.001 Ω – 200.000 Ω	
200.01 Ω – 2000.00 Ω	0.02 %
2.0001 kΩ – 20.0000 kΩ	
20.001 kΩ – 200.000 kΩ	
0.20001 MΩ – 2.00000 MΩ	
2.0001 MΩ – 20.0000 MΩ	0.05 %

M641 Resistance accuracy

Range / Resolution	*Accuracy*
10.000 0 Ω – 20.000 0 Ω	0.05 % + 15 mΩ
20.001 Ω – 200.000 Ω	
200.01 Ω – 1000.00 Ω	0.02 %
1.0001 kΩ – 3.0000 kΩ	
3.001 kΩ – 10.000 kΩ	
10.01 kΩ – 30.00 kΩ	0.05 %
30.1 kΩ – 100.0 kΩ	0.1 %
101 kΩ – 300 kΩ	0.5 %

Application of M630 series

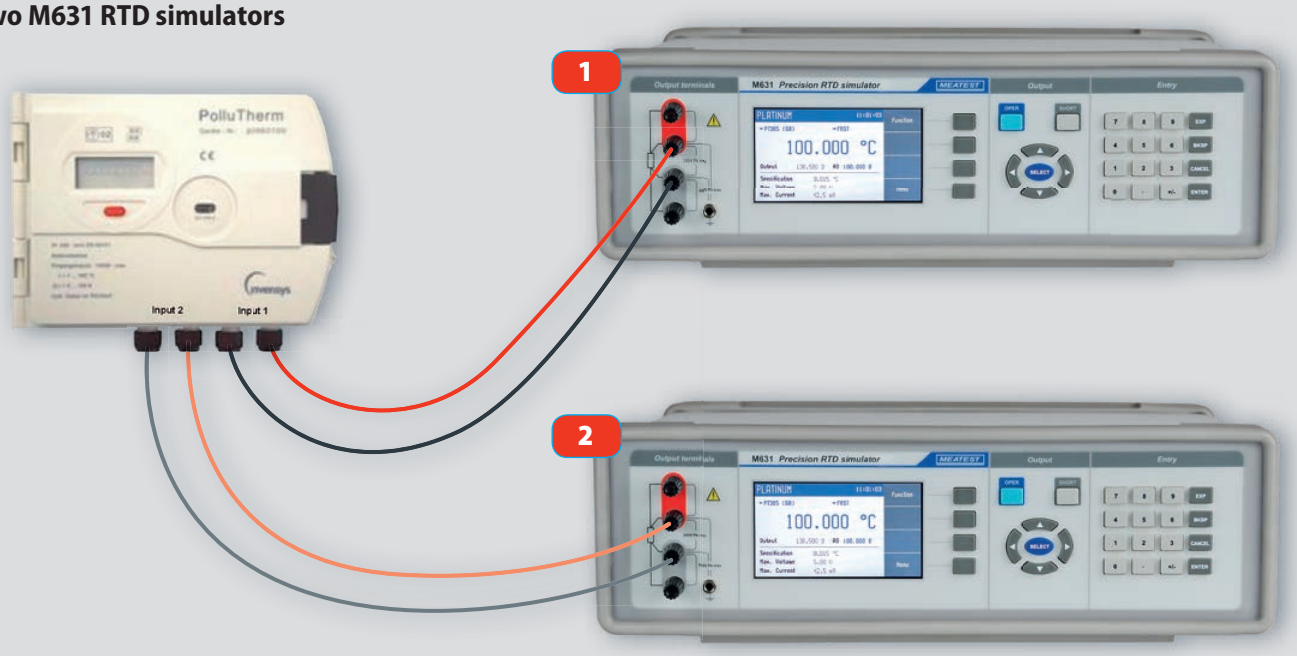

M600 Series Programmable Resistance Decades and RTD Simulators
Thermometer calibration
4 W connection, accuracy 0.01 °C, remote control
Ohmmeter calibration
4W connection, accuracy 30ppm, remote control

Checking of meters (evaluation units) connected to resistance based sensors:

- position sensors
- rotary sensors
- temperature sensors
- heat meters

Application of M630 series

Calibration of heat meters using two M631 RTD simulators



RTD simulators here simulate the temperatures of input and output water of the system.

M63x Pt simulation accuracy

Temperature	*M632*		*M631*	
	Pt10 … Pt99	Pt100 … Pt20000	Pt100 … Pt500	Pt501… Pt1000
-200.000… 0.000 °C	0.05 °C	0.01 °C	0.01 °C	0.01 °C
0.001… 200.000 °C	0.06 °C	0.015 °C	0.015 °C	0.02 °C
200.001… 500.000 °C	0.08 °C	0.03 °C	0.03 °C	0.04 °C
500.001… 850.000 °C	0.1 °C	0.04 °C	0.04 °C	0.1 °C

M64x Pt simulation accuracy

Temperature	*M642*		*M641*
	Pt10 … Pt99	Pt100 … Pt20000	Pt100 … Pt1000
-200.00 … 0.000 °C	0.5 °C	0.15 °C	0.15 °C
-0.001 … 850.000 °C	1.0 °C	0.2 °C	0.2 °C

M63x Ni simulation accuracy

Temperature	*M632*		*M631*	
	Ni10 … Ni99	Ni100 … Ni20000	Ni100 … Ni500	Ni501… Ni1000
-60.000… 0.000 °C	0.05 °C	0.01 °C	0.01 °C	0.01 °C
0.001… 300.000 °C	0.05 °C	0.01 °C	0.01 °C	0.02 °C

M64x Ni simulation accuracy

Temperature	*M642*		*M641*
	Ni10 … Ni99	Ni100 … Ni20000	Ni100 … Ni1000
-60.000…300.000 °C	0.4 °C	0.1 °C	0.1 °C

M63x Frequency response

AC/DC difference	*M632*							*M631*				
	1 Ω	*10 Ω*	*100 Ω*	*1 kΩ*	*10 kΩ*	*100 kΩ*	*1 MΩ*	*16 Ω*	*100 Ω*	*1 kΩ*	*10 kΩ*	*100 kΩ*
100 Hz	0.01 %	0.01 %	0.01 %	0.01 %	0.01 %	0.1 %	2 %	0.01 %	0.01 %	0.01 %	0.01 %	0.2 %
1 kHz	0.02 %	0.01 %	0.01 %	0.01 %	0.03 %	1 %		0.01 %	0.01 %	0.01 %	0.03 %	1 %
10 kHz	0.2 %	0.03 %	0.01 %	0.1 %	1 %			0.03 %	0.01 %	0.03 %	1 %	

M64x Frequency response

AC/DC difference	*M642*									*M641*				
	100 mΩ	*1 Ω*	*10 Ω*	*100 Ω*	*1 kΩ*	*10 kΩ*	*100 kΩ*	*1 MΩ*	*10 MΩ*	*10 Ω*	*100 Ω*	*1 kΩ*	*10 kΩ*	*100 kΩ*
100 Hz	0.05 %	0.02 %	0.01 %	0.01 %	0.01 %	0.02 %	0.02 %	0.1 %	10 %	0.01 %	0.01 %	0.01 %	0.01 %	0.01 %
1 kHz	0.2 %	0.1 %	0.02 %	0.01 %	0.01 %	0.1 %	0.1 %	10 %		0.01 %	0.01 %	0.01 %	0.02 %	0.10 %
10 kHz	5 %	0.5 %	0.1 %	0.03 %	0.03 %	2.0 %	10 %			0.05 %	0.02 %	0.02 %	0.5 %	10 %

General specification

Maximal voltage:	200 V pk
Maximal current:	500 mA
Total power dissipation:	0.25 W (M63x) 5 W (M64x)
Temperature coefficient:	10 % of specification per °C outside the reference temp. range
Reaction time:	6 ms
Switching method:	Fast / Smooth / Via short / Via open
Terminals:	gold plated terminals 4 mm
Remote control:	RS232 interface (optionally USB, LAN, IEEE488)
Power supply:	115/230 VAC, 50/60 Hz
Reference temperatures:	+20 °C … +26 °C
Working temperatures:	+5 °C … +40 °C
Storage temperatures:	-10 °C … +50 °C
Dimensions:	W 390 mm, H 128 mm, D 310 mm
Weight:	5.2 kg (M63x) 4.0 kg (M64x)

Basic accessory (included)

Cable RS 232
Application software
User's manual

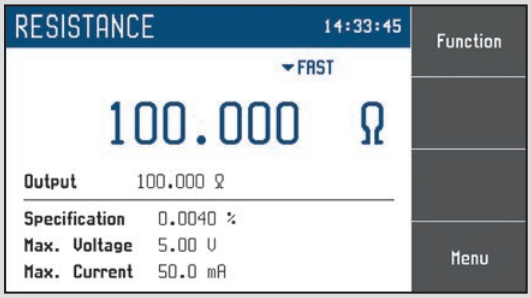
Options (extra ordered)

Bus	M6xx-V1xxx – RS232
	M6xx-V2xxx – RS232, USB, LAN, GPIB
Housing	M6xx-Vxx0x – table version
	M6xx-Vxx1x – module 19", 3HE

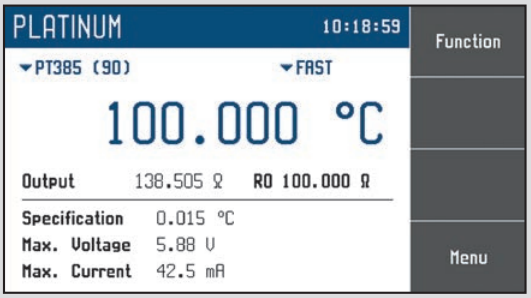
M642

Design for industry – 19" rack module, height 3HE

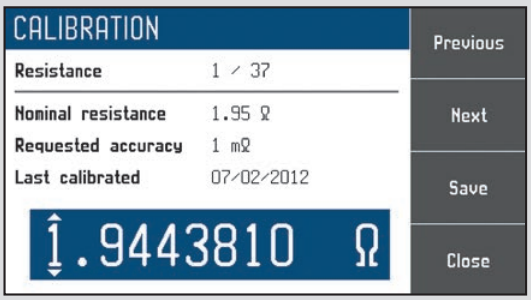
Resistance



Temperature



Recalibration



M-109R High Resistance Decade

- Calibration of insulation meters and megaohmmeters
- 4 decades
- Range 1 MOhm – 12 GOhm
- Maximum working voltage 5 kV
- Internal battery or power line adapter supplying
- RS 232 control

High resistance decade box is designed for calibrating of insulation meters and megaohmmeters. It is suitable for calibration laboratories and service centres, where can be used also for testing or setting of high resistance meters. High voltage relays with extremely high insulation resistance are used for switching of resistance components.

M-109R is equipped with indication of input terminal overload. Instrument is supplied from accumulator or power line adapter. Control is possible manually or remotely via serial interface RS-232.

Specification

Range of resistance:	1 MΩ - 12.221 GΩ
Maximum voltage:	5kV DC between terminals H-L, H-GND, L-GND
Connection:	two-terminal, three-terminal (GUARD)
Type of terminals:	high voltage terminals with ERTALYTE isolation
Remote control:	serial interface RS-232
Supply:	internal accumulator, power line supply adapter 15 V (100-240 V/50-60 Hz)
Temperature range:	23 °C ± 5 °C
Relative humidity:	10 - 50 %
Dimensions:	364 mm x 111 mm x 316 mm
Weight:	4 kg

Accuracy

Decade	*Nominal value accuracy*	*Voltage coefficient*	*Temperature coefficient*	*Maximum voltage*
	[%]	*[± ppm/V]*	*[± ppm/°C]*	*[VDC/RMS]*
1 MΩ - 11 MΩ	0.1	1	< 100	1000/700
10 MΩ - 110MΩ	0.2	1	< 100	2500/1700
100 MΩ - 1.1 GΩ	0.5	2	< 100	5000/3500
1 GΩ - 12 GΩ	1.0	2	< 100	5000/3500

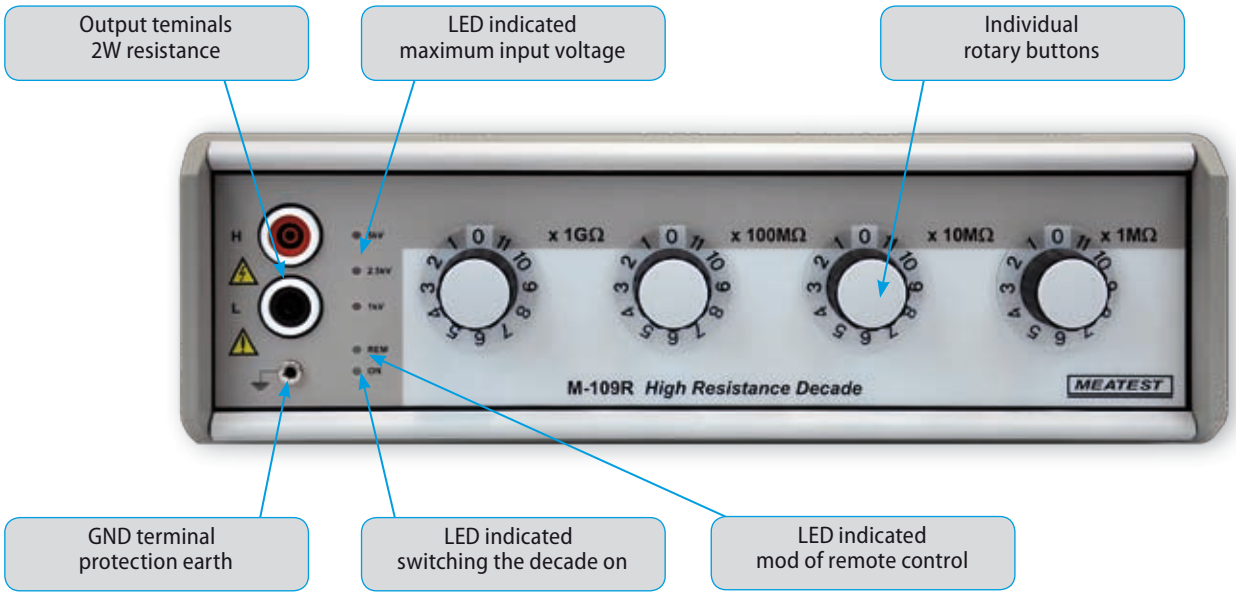
Basic accessory (included)

Power line adapter
Cable RS-232
CD with application software
User's manual
Test report

Options (extra ordered)

Test lead 5000 VDC / 20 A

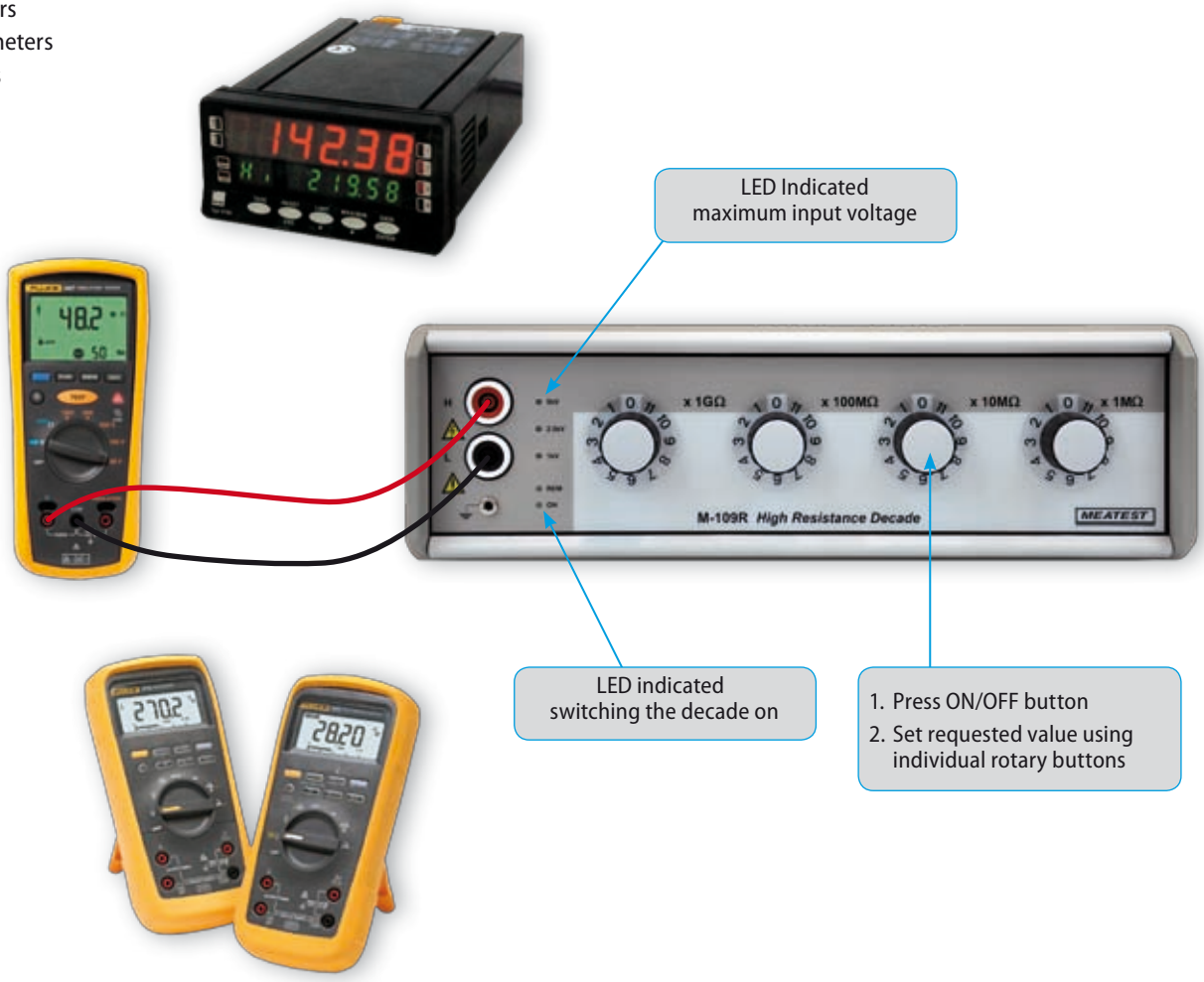
Front panel



Application

Calibration and verification of meters with test voltage up to 5 kVDC:

- Insulation testers
- Safety testers
- Megaohmmeters
- Ohmmeters



M191 Insulation Tester Calibrator

M191

- Programmable high voltage high resistance decade box
- Resistance range from 10 kΩ to 1 TΩ
- Operating voltage range up to 10 kVDC
- Grounded or floating operation
- Built-in three fix value high voltage capacitors from 10 nF to 100 nF
- Built-in monitoring voltmeter
- SHORT function for short current testing of UUTs
- Timer function for testing of UUTs
- Easy recalibration using front panel keypad
- GPIB & RS232 interface

M191 calibrator is based on programmable high resistance decade with additional electronic circuits allowing calibration of not only resistance ranges, but also calibration of UUT test voltage, short current testing, verifying of functions of measuring dielectric parameters like polarization index (PI), dielectric absorption ratio (DAR) and polarization ratio (PR). The calibrator can be also used to verify timer function of the UUT.
Main feature of the calibrator is High resistance source mode. In this mode any resistance value in range from 10 kΩ to 1 TΩ adjustable with 4 digit resolution can be set and connected to the output terminals. Maximum allowed working DC voltage is from range 50 V to 10 000 V depending on set resistance. Switching the resistance value under test voltage is allowed in limited voltage range. In this range it the basic accuracy is 0.1 % to 5 % depending on set resistance value.

The calibration can be controlled manually using front panel keypad or in remote mode using one of two types of interfaces GPIB, RS-232. The calibrator can easily fit within calibration systems featuring CALIBER software support.

Specification

Function HVR (High resistance programmable decade box)

Total resistance range:	10.00 kΩ to 1000.0 GΩ
Test voltage range:	10 000 VDC + 5 % over range
Maximum applicable voltage during over-switching:	3 000 VDC (without output terminals disconnection)
Test voltage indication:	4 digit meter with range of 10 kVDC with suppressed indication below 50 VDC
Test voltage accuracy:	0.5 % + 10 V
Test current indication:	4 digit meter in range from 0.01 pA to 99.99 mADC
Maximum safe DC voltage between H and L terminal:	11 000 VDC
Maximum allowed DC voltage between L and GND terminal:	15 VDC

Accuracy in grounded mode (G) and floating mode (F):

Resistance range	*Accuracy in G mode**	*Accuracy in F mode**	*Maximum DC test voltage****	*Typical voltage dependency*	*Test voltage accuracy*	*Test current range*	*Test current accuracy*
10.00 kΩ – 99.99 kΩ	0.2 %	0.2 %	65 V	< 0.05 ppm/V	0.5 % + 10 V	10 mA	0.7 % + 100 µA
100.0 kΩ – 999.9 kΩ	0.1 %	0.1 %	315 V			2.5 mA	0.7 % + 10 µA
1.000 MΩ – 9.999 MΩ			1 250 V			1 mA	0.7 % + 1 µA
10.00 MΩ – 99.99 MΩ			5 000 V			500 µA	0.7 % + 100 nA
100.0 MΩ – 499.9 MΩ	0.2 %	0.2 %	10 000 V			100 µA	0.7 % + 20 nA
500.0 MΩ – 999.9 MΩ				< 0.07 ppm/V		20 µA	1 % + 10 nA
1.000 GΩ – 9.999 GΩ	0.5 %	0.5 %		< 0.15 ppm/V		10 µA	1.5 % + 1 nA
10.00 GΩ – 19.99 GΩ	1 %	1.0 %				1 µA	1.5 % + 500 pA
20.00 GΩ – 99.99 GΩ		2 %		< 0.20 ppm/V		500 nA	2 % + 100 pA
100.0 GΩ – 299.9 GΩ	2 %	3 %				100 nA	5 % + 20 pA
299.9 GΩ – 1000.0 GΩ	5 %	6 %			N/A**	N/A**	N/A**

* Accuracy is valid in reference temperature range 23+/-2 °C with RH < 50 %.
** Test voltage voltmeter function is not available in resistance range from 299.9 GΩ to 1 000 GΩ.
*** Maximum measured DC test voltage is 5 % over the specified range

SHORT function for Short test current verification

Current range:	0.000 – 5.000 mA DC
Input resistance:	2700 Ω nom.
Short test current accuracy:	0.2 % + 5 uA

HVC function, high voltage capacitance

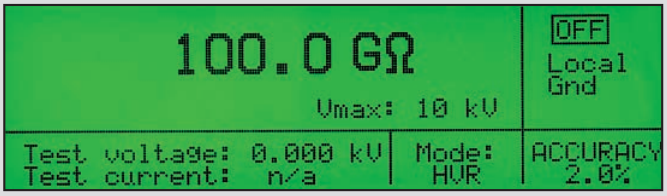
Range of capacitance:	10, 50, 100 nF fix values
Tolerance:	± 10 %
Calibration value uncertainty:	0.3 % + 200 pF
Max. test voltage:	5 000 VDC + 5 % over range
Test voltage indication:	0 to 5 000 kVDC with suppressed indication bellow 50 VDC
Test voltage accuracy:	0.5 % + 10 V

General specification

Warm up time:	15 minutes
Operating temperature:	23 ± 10 °C, Relative humidity < 70 %
Reference temperature:	23 ± 2 °C, Relative humidity < 50 % for resistance range from 10 kΩ to 1 000 GΩ Relative humidity < 70 % for resistance range from 10 kΩ to 10 GΩ
Temperature coefficient:	Additional resistance uncertainty due to temperature coefficient for temperature outside of Tcal ± 2 °C: from + 13 °C to +33 °C add 0.1 x specified accuracy / °C at reference temperature
Humidity coefficient:	Additional uncertainty due to humidity coefficient in range 50 to 70 % RH is: - 0.15 x specified accuracy / % RH for range 10.00 GΩ to 1 000.0 GΩ - 0.05 x specified accuracy / % RH for range 100.0 MΩ to 9.99 GΩ - 0.02 x specified accuracy / % RH for range 10.00 kΩ to 99.99 MΩ
Storage temperatures:	-10 °C … + 55 °C
Dimension:	W 450 mm, H 150 mm, D 430 mm
Netto weight	12 kg
Power line:	115/230 VAC, 50/60 Hz
Power consumption:	40 VA

Following information is displayed on the display:

- Set resistance value in Ω.
- Maximum safe test voltage that can be applied to the output terminals.
- Actual test voltage. This is value of DC test voltage sourced by UUT and connected to the calibrator output terminals.
- Test current.
- Accuracy. Selected resistance point accuracy shown in %.



M-192/192A Programmable AC/DC Load
High Power Programmable Resistance Decade Box

3000 W

- **Resistance range 15 Ω to 300 kΩ**
- **Maximal load 3 kW**
- **Maximal voltage 250 V RMS**
- **Accuracy 0.1 %**
- **Temperature coefficient < 10 ppm/°C**
- **2, 4 – wire connection**
- **Interface RS – 232 (IEEE488 optionally)**
- **Table version (19" module as option)**

M-192 AC/DC load is determined for testing voltage sources, transformers or generally as power load up to 3 kW. Load is especially suitable for automated testing systems.
Thanks to good accuracy and remote control feature M-192 load can be used in calibration laboratories, production lines, service centers and development departments. For use in industry is designed version in 19" module with height 4 HE.
Among advantages belongs features like simple control from the front panel, indication of set-up values on LCD display, resistance, power and current modes, remote control via RS-232 or IEEE488 bus.

Specification

Resistance range	15 Ω - 4700 Ω / 15 Ω - 300 kΩ (version M-192A)
Resolution	0.1 Ω to 1 Ω for M-192 version, 0.001 Ω to 1 kΩ for M-192A version
Temperature coefficient	< 10 ppm/°C
Maximal dissipation power	3000 W
Maximal voltage	250 V RMS
Internal voltmeter (M-192A only)	range 300V AC/DC, AC/DC automatic selection, resolution 0.1 V
Connection	2, 4 wires
Range of reference temperatures	+18 °C … +28 °C
Range of operating temperatures	+5 °C … +45 °C
Storing temperatures	-10 °C … +60 °C
Housing	metal
Dimensions and weight	W 460 mm, H 190 mm, D 440 mm (without holders), 15 kg
Isolation resistance between signal outputs and housing	> 2 GΩ (at 1000 Vdc)

Content of delivery

M-192/192A Programmable AC/DC Load
Operation manual
Power cable
Test report

Versions

Interface	M192-V1xxx - RS232
	M192-V2xxx – IEEE488
Housing	M192-Vxx0x – table version
	M192-Vxx1x - module 19", 4 HE

Resistance accuracy (M-192 only up to 4700 Ω)

Range	Accuracy		
	DC…120Hz	120Hz…1kHz	1kHz…10kHz
15.000 Ω - 99.999 Ω	0.1 % + 30 mΩ	0.2 % + 30 mΩ	0.2 % + 30 mΩ
100.000 Ω - 3.000 kΩ	0.1 %	0.1 %	0.2 %
3.001 kΩ - 30.00 kΩ	0.1 %	0.1 %	2,00%
30.1 kΩ - 100.0 kΩ	0.2 %	0.2 %	—
101 kΩ - 300 kΩ	0.5 %	2,00%	—

Internal voltmeter (M-192A only)

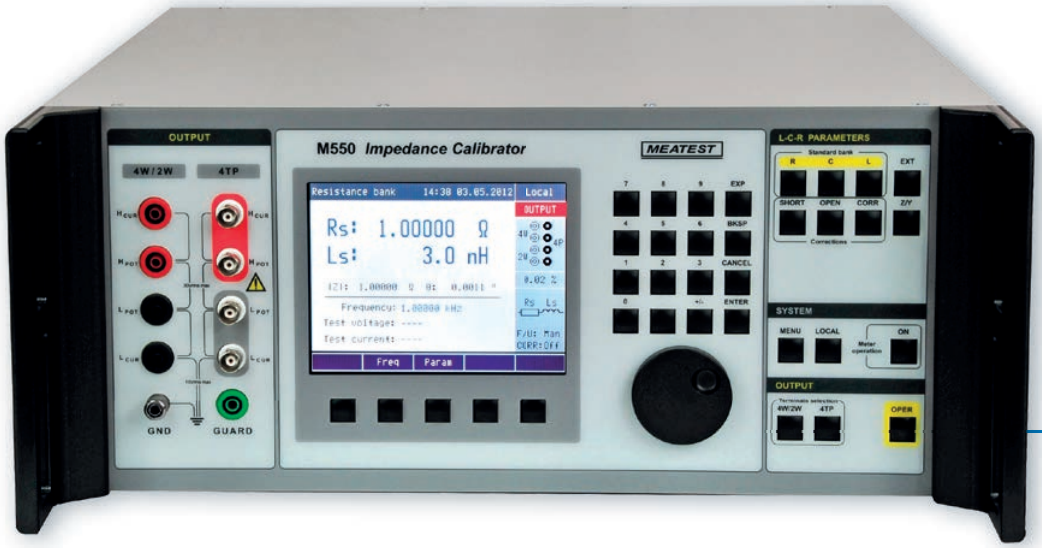
Range	Accuracy	
	DC	AC
1.0 - 299.9 V	0.1 % + 0.2 V	0.2 % + 0.2 V

Typical frequency response (M-192A)

R_{nom}		100Hz	1kHz	10kHz	100kHz	1MHz
15 Ω	Z [Ω]	15	15	15	15,03	15,15
	Ø [°]	0	0,03	0,26	2,4	23
100 Ω	Z [Ω]	100	100,01	100,02	99,97	91,5
	Ø [°]	0	0,01	0,08	0,75	9,1
330 Ω	Z [Ω]	330	330,02	330,03	329,73	301,3
	Ø [°]	0	0	0,01	0,08	4,1
1000 Ω	Z [Ω]	1000	1000	999,9	997	854
	Ø [°]	0	-0,02	-0,18	-1,7	-9
10 kΩ	Z [kΩ]	10	10	9,97	9,21	3,15
	Ø [°]	-0,02	-0,23	-2,2	-19	-57
100 kΩ	Z [kΩ]	100	99,78	91,7	27	N.A.
	Ø [°]	-0,18	-2,3	-20,5	-70,4	

Application

M550 Impedance Calibrator



M550

- Calibration of LCR meters
- Resistance range 100 mΩ to 100 MΩ
- Capacitance range 10 pF to 100 µF
- Simulated inductance standards 10 µH to 10 H
- Best calibration uncertainty 0.02 % at 1 kHz
- Applicable frequency range up to 1 MHz
- Interface RS232 & IEEE488
- Four pair coaxial terminal connection, four terminal connection, two terminal connection
- OPEN and SHORT reference functions

Model M550 Impedance calibrator is designed for calibration of LCR meters. The calibrator consists of several banks of resistance, capacitance and inductance standards of fix decimal values. Total range cover values from 0.1 Ω to 100 MΩ, 10 pF to 100 µF and 10 µH to 10 H. Calibrator has four-pair terminal and four terminal coaxial output connectors for calibration of precise and wide range LCR meters, four-terminal and two-terminal non-coaxial output connectors for calibration of simple LCR meters and older LCR meters.

Basic applicable frequency range is from 20 Hz to 1 MHz in coaxial mode and up to 100 kHz in non-coaxial mode.
Calibration memory stores both real and complex parameters of all partial standards. Calibration values can be displayed in wide range of frequently used pairs of complex impedance and admittance. Either parallel or series equivalent model can be selected. The calibrator is equipped with reference positions OPEN and SHORT terminals to eliminate test cable influence.

Built-in level meter of voltage and frequency of LCR meter test signal comes as standard. M550 is compatible with Meatest automation software CALIBER.

Specification

Modes:	4TP four pair terminal, 4 W four terminal, 2 W two terminal
Output terminals:	4x BNC connectors for coaxial output (4TP) 4x banana terminal for non-coaxial output (2 W/4 W)
Frequency range:	20 Hz to 1 MHz
Reference correction positions:	SHORT, OPEN

Resistance

Range:	0.1 Ω to 100 MΩ (fix decimal values)
Deviation to nominal value:	0.10 % to 10 % depending on value and mode
Calibration uncertainty:	0.02 % to 1 % at 1 kHz depending on value and mode
Temperature coefficient:	2 to 25 ppm/°C

Capacitance

Range:	10 pF to 100 µF (fix decimal values)
Deviation to nominal value:	< 5 %
Calibration uncertainty:	0.05 % to 5 % at 1 kHz depending on value and mode
Temperature coefficient:	30 to 100 ppm/°C

Inductance (simulated in 4TP mode only)

Range:	10 µH to 10 H (fix decimal values)
Deviation to nominal value:	< 15 %
Calibration uncertainty:	0.1 % to 4 % at 1 kHz depending on value and mode
Temperature coefficient:	50 ppm/°C max.

Test level meter

Frequency range:	20 Hz to 100 kHz
Voltage range:	200 mV to 10 V rms
Test voltage accuracy:	2 to 5 %

General data

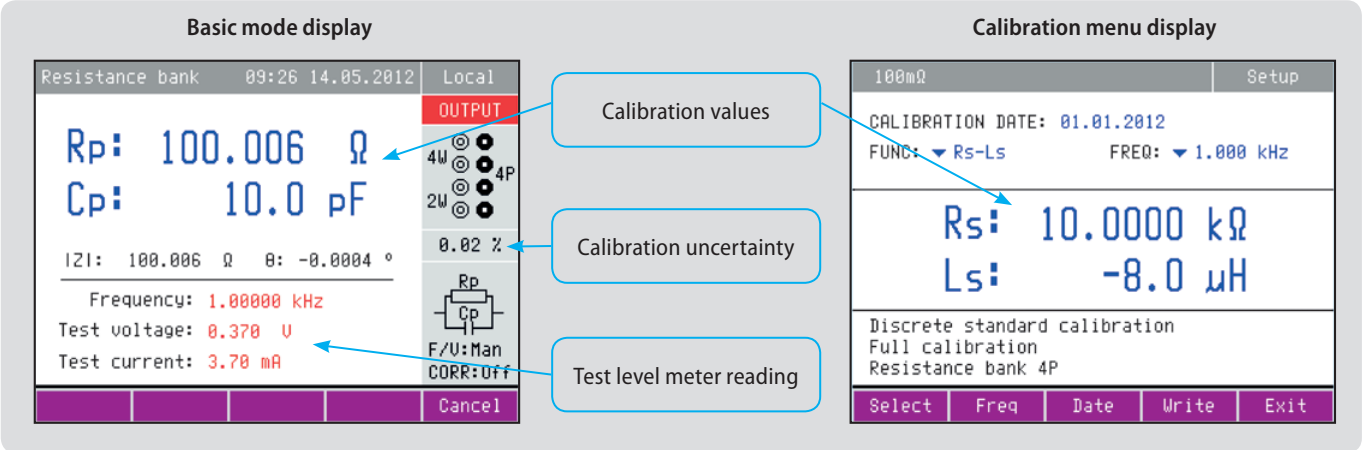
Interface:	RS232, GPIB
Operating temperature:	15 … 30 °C
Storage temperature:	-10 … +40 °C
Dimension:	W 450 mm, H 150 mm, D 430 mm
Net weight:	12 kg
Power line:	115/230 VAC, 50/60 Hz
Consumption:	45 VA

Automation of LCR meter calibration

M550 Impedance calibrator application combines precise and frequency independent partial standards of electric resistance, capacitance and inductance in one instrument. Both manual and remote control is available making the M550 an effective tool for manual or automatic adjustments, verifications and calibrations of various types of LCR meters. In 4TP mode the calibrator enables verification of LCR meter in frequency range up to 1 MHz. Calibration values either with or without test cable length correction are selectable.

Recalibration procedure

M550 calibration menu offers comfortable recalibration of calibration data. Two basic methods are implemented to make the recalibration easier. Full recalibration enables access to all stored complex calibration values of all partial standards in spot frequencies. Modification of frequency characteristics is fully accessible in this method. Offset recalibration simplifies the process of recalibration to modification of main parameter at 1 kHz only. Difference from the previous calibration value is automatically projected to all spot frequencies.



MTE LF Resistance/Capacitance/Inductance Standards

MTE

- Traceability of electric quantities
- Calibration of meters
- Calibration uncertainty 0.005 %
- Low time constant
- Three/four terminal or four pair terminal connection

Resistance/Capacitance standards of series MTE are designed for calibration of ohmmeters, RCL meters, insulation testers calibration. They can be applied as a mean of traceability of electric resistance between primary and secondary laboratories.

DC modification of the standards is equipped with 4 mm terminal socket. Resistance standards up to 1 MΩ are in four-terminal connection while standards over 10 MΩ have two terminal connection with additional insulation washer and with grounding terminal connected to the housing.

AC resistance versions and capacitance/inductance standards are delivered with four BNC connectors enabling application in three-terminal, four-terminal, four-pair terminal configuration. As a part of MTE set for AC applications the reference positions OPEN and SHORT terminals can be delivered. Both components serve typically for zero calibration of RCL meters.

Other type of connectors can be installed on request. Other nominal values can be delivered on request.

LF Capacitance standards MTE series

Connection	Four pair terminal
Type of terminals	BNC coaxial connectors for AC applications
Frequency range	20 Hz - 20 kHz to 1 nF, 20 Hz – 10 kHz to 100 uF

Model	*Nominal value*	*Accuracy*	*1 kHz calibration uncertainty*	*Temperature coefficient*	*Dissipation factor*	*Note*
		[%]	*[%]*	*[± ppm / °C]*	*[-]*	*Type*
CP – 10p	10 pF	1	0.01	15	≤ 0.001	Ceramic multilayer Silver mica
CP – 100p	1 00 pF	0.1	0.01	15	≤ 0.001	Ceramic multilayer Silver mica
CP – 1n	1 000 pF	0.1	0.01	15	≤ 0.0005	Silver mica
CP – 10n	10 000 pF	0.1	0.01	15	≤ 0.0005	Silver mica
CP – 100n	100 000 pF	0.1	0.01	15	≤ 0.0005	Silver mica
CP – 1u	1 uF	0.1	0.01	50	≤ 0.0005	Polypropylen
CP – 10u	10 uF	0.2	0.1	50	≤ 0.005	Polypropylen
CP – 100u	100 uF	0.2	0.1	50	≤ 0.005	Polypropylen

LF Inductance standards MTE series

Connection — Four pair terminal
Type of terminals — BNC coaxial connectors
Frequency range — 100 Hz – 20 kHz

Model	Nominal value	Accuracy	1 kHz calibration uncertainty	Temperature coefficient	Min. quality factor for f=1 kHz	Note
		[%]	[%]	[± ppm / °C]	[-]	Type
LP – 100m *	100 mH	0.5	0.05	50	≥ 3 ***	T-network
LP – 1**	1 H	0.5	0.05	50	≥ 3	T-network
LP – 10	10 H	0.5	0.05	50	≥ 10	T-network
LP – 100	100 H	0.5	0.05	50	≥ 10	T-network
LP – 1000	1000 H	0.5	0.05	50	≥ 10	T-network

T network is composed from two resistors and one capacitor. The network can simulate inductance parameter L21 with Q factor over 3 in recommended frequency area.
The standard can be applied for calibration of those RCL meters which measure test current in Low input terminal. The standard cannot be applied for calibration of classic transformer bridges.

* Applicable frequency range from 10 to 20 kHz; ** Applicable frequency range from 1 kHz to 20 kHz; *** Q factor for frequency 10 kHz

LF Resistance standards MTE series

Connection — 3-terminals (above 10 MΩ), 4-terminals or 4 pair-terminals (bellow 10 MΩ)

Housing
- type MTE1 — for general application with BNC terminals or gold plated terminals. Dimensions 125 x 60 x 105 mm
- M-530 — for RCL meter calibration designed for direct connection to the front panel connectors with two fixing female BNC screws. Dimensions 105 x 33 x33 mm

Type of terminals
- BNC coaxial connectors for AC applications (0.1 Ω to 10 MΩ)
- Gold plated terminals for DC applications (0.1 Ω to 10 MΩ)
- Standard terminals with additional ertallyte isolation (above 10 MΩ)

Frequency range — DC to 20 kHz for nominal value 0.1 Ω to 10 MΩ (with BNC connectors)

Model	Nominal Value	Accuracy	DC calibration uncertainty	Temperature coefficient *	Power rating **	Note
		[%]	[%]	[± ppm / °C]	[W]	Resistance segment
RP – 0.1	100 mΩ	0.1	0.05	10	3	Foil resistor
RP – 1.0	1 Ω	0.05	0.01	10	3	Foil resistor
RP – 1.0	1 Ω	0.05	0.01	1	3	Foil resistor
RP – 10	10 Ω	0.01	0.005	1	0.3	Foil resistor
RP – 100	100 Ω	0.01	0.005	1	0.3	Foil resistor
RP – 1k	1 kΩ	0.01	0.005	1	0.3	Foil resistor
RP – 10k	10 kΩ	0.01	0.005	1	50 V ***	Foil resistor
RP – 100k	100 kΩ	0.01	0.005	1	150 V ***	Foil resistor
RP – 1M	1 MΩ	0.01	0.005	1	500 V ***	Foil resistor
RP – 10M	10MΩ	0.05	0.01	100	2 500 V***	Ceramic resistor
RP – 100M	100 MΩ	0.5	0.1	100	2 500 V***	Ceramic resistor
RP – 1G	1 GΩ	1	0.3	100	5 000 V***	Ceramic resistor
RP – 10G	10 GΩ	3	0.5	100	5 000 V***	Ceramic resistor

* in temperature range 0–50 °C; ** for ambient temperature 23 °C; *** maximal voltage

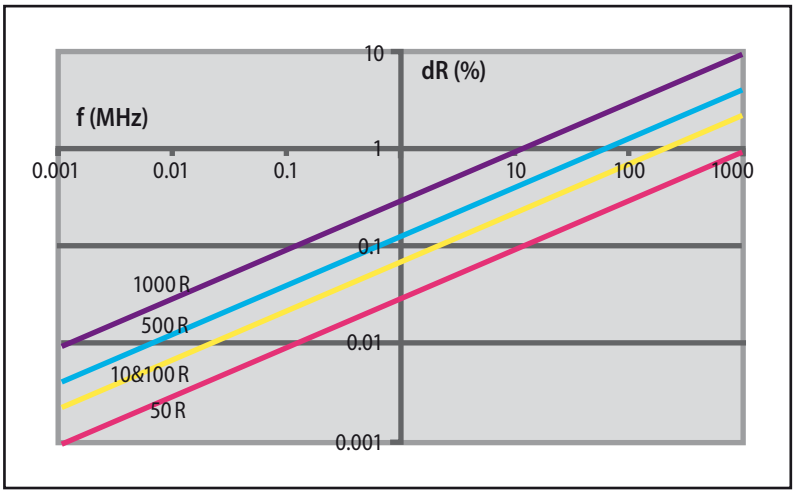
M-530 RF Resistance/Capacitance Standards

M-530

- Resistance range 10 Ω to 1000 Ω
- Very low frequency dependency
- Applicable frequency range to 100 MHz
- Calibration of wide frequency range LCR meters

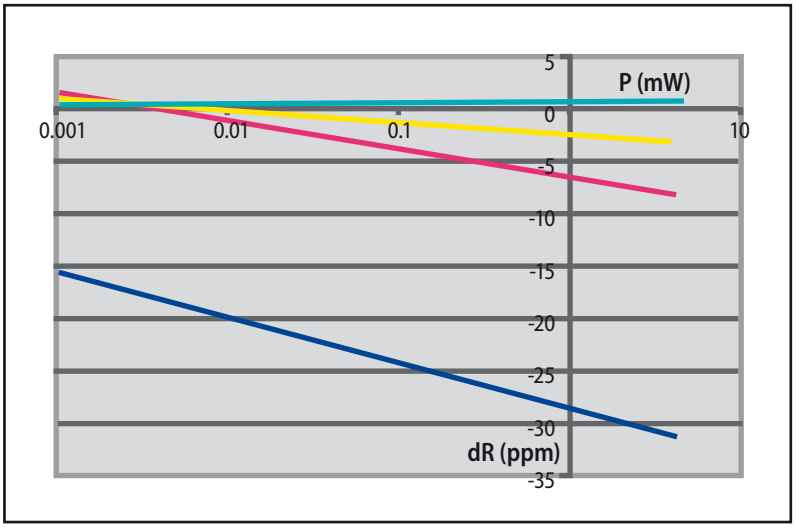
The resistance standard set is designed especially for calibration of LCR meters in frequency range from DC to 100 MHz. The standards are equipped with four coaxial BNC connectors. Wide frequency range is achieved by applied HF design using strip line technology. Four-pair terminal connection with 22 mm distance between them enables direct connection to the UUTs without need to apply test leads.

The standards are available with nominal value 10, 50, 100, 500, 1000 Ω in 1% tolerance. Reference positions OPEN and SHORT for easy "zero" compensation are available as well.



Frequency dependency

Applicable frequency range of the resistance standards depends on nominal resistance value and requested maximal deviation.
Typical frequency characteristics are shown in the diagram.



Load parameters

Maximal electric power dissipated in the standards is limited due to small size of applied resistive segments.
Typical relative change of the resistance value when loaded with 5 mW electric power is shown in the graph bellow.

Time constant

Extremely low time constant of the resistance standards is given by high frequency design and RF resistance segments.
The time constant value is in order of 10^{-10} to 10^{-11} s.

Temperature coefficient

Typical temperature coefficient is 0.2 ppm/°C for nominal values 10, 50, 100 Ω and 15 ppm/°C for values 500 and 1000 Ω.

Technical specification

Model	*Nominal value*	*Max. deviation to nominal value*	*Maximal frequency for 0.1% deviation*	*Maximal frequency for 1% deviation*	*Time constant*	*Temperature coefficient*	*Maximal test current*
	Ω	*%*	*MHz*	*MHz*	*s*	*ppm/°C*	*mA*
M530–10R	10	1	2	200	< 2.10–10	< 1	40
M530–50R	50	1	10	> 500	< 2.10–10	< 1	20
M530–100R	100	1	2	200	< 5.10–11	< 1	12
M530–500R	500	1	0.5	50	< 2.10–10	< 25	6
M530–1000R	1000	1	0.1	10	< 2.10–10	< 25	4
OPEN	—	—	2	200	—	—	—
SHORT	0	—	2	200	—	—	100

Self-inductance: < 0.08 µH
Connection: 4 x BNC male connector
Distance between connectors: 22 mm
Dimensions: 105 x 34 x 50 mm (including connectors)
Housing: aluminum
Range of working temperatures: 15 – 30 °C

Application

Calibration of LCR metrers

The standards are equipped with BNC connectors with spacing which equells spacing of input terminals of most frequently used LCR meters.
Calibration in this way excludes thé most significant uncertainties related to cabelling.

TM-185D Temperature/ Humidity Monitor

TM-185D

- Temperature and relative humidity measurement
- Real time data
- Large LED display
- Data logging capacity 30 000 records
- Alarm set for Hi and Low limit Temperature and Humidity
- USB interface

TM-185D is measuring instrument, which measures, displays and saves information about reference conditions in laboratories. It measures ambient temperature and relative humidity. Wide time range of ambient conditions can be scanned and recorded by setting of appropriate interval of recording. When power line supplying is interrupted, monitor operates from internal back-up source without losing any formerly stored data.

TM-185D can be used independently or as a part of automated calibration systems. It is supported by calibration software WInQbase. Basic delivery contains the instrument with temperature/humidity sensor, AC/DC adapter and software for transferring of measured values to a PC. The instrument ensures the requirements of standards ISO 9000/45001, which calibration laboratory have to fulfil.

Technical parameters

Temperature

Temperature range:	-20 … 60 °C
Temperature accuracy:	1 °C (in range -5 … 40 °C) 2 °C (outside the range -5 … 40 °C)
Temperature resolution:	0.1 °C
Update rate:	1 s

Relative humidity

Humidity range:	5 - 95 % RH
Humidity accuracy:	2 % (in range 25 °C, 35 … 80 % RH) 2.5 % (in range 25 °C, 10 … 35 and 80 … 90 % RH) 5 % (for 25 °C, other ranges)
Humidity resolution:	0.1 %
Update rate:	4 s

General parameters

Data logger capacity	30000 samples	
Power supply	AC/DC adapter 9V/1A, backup battery 9V	
Interface	USB	
Size	260 x 178 x 47 mm	
Weight	1000 g	
Other functions	temperature and humidity alarm limits	PC user software (CD ROM)

M-301 Precision Oil Bath

- Capacity 55 l of oil
- Temperature stability 0.002 °C
- Automating mode of tempering
- Manual operation
- Interface bus GPIB

M-301 Precision oil bath is a device which is able to hold choice temperature of a work liquid of a total volume of 55 litres with a great accuracy. It is especially determined for tempering standards of electric quantities, for calibrating thermometers and temperature scanning sensors. All thermostat functions are operable on interface bus GPIB. A possibility of a system operation even enables an active control of a temperature rise slope. The thermostat is equipped with protections which automatically disconnect all power elements in a case of detection of any anomaly when running. It is equipped with STBY mode which enables holding of the working liquid temperature within a selected tolerance zone even when a proper thermostating is disconnected. A DAY mode switches over the thermostat function from a thermostating function into a STBY function at an in-advance programmed hour.

Basic temperature range of the working liquid is from $T_{ambient}$ – 5 °C to 55 °C..

Technical parameters

Range of reachable temperature:	Tamb – 5 to +55 °C
Cooling slope at a difference of oil and ambient temperatures of 1 °C:	1,5 °C / hour for type
Non-homogenity of temperature field inside working space:	0,01 °C max.
Temperature stability after setting:	0,002 °C / 5 hours
Temperature set-up resolution:	0,001 °C
Temperature adjustment accuracy of working liquid in range ± 5 °C from calibrating point:	0,05 °C
Working space dimensions:	440 x 325 x 250 mm
Overall dimensions:	1145 x 500 x 370 mm
Power input of heating element:	350 VA
Power input of cooling elements:	150 VA for type
Power supply voltage:	220–230V / 50–60 Hz

M-520 Programmable Capacitance Decade

M-520

- Designed for RCL meters calibration
- Range from 100 pF to 12 µF
- Basic accuracy 0.25 %
- Maximal operating voltage 50 V
- Power supplying from internal battery or power line adapter
- Remote control RS-232

Capacitance decade is designed especially for calibration of capacitance ranges of multimeters and RCL meters. Due to its versatility it can be applied in calibration laboratories, repair centres and in production lines, where remote control of capacitance is requested. Main parts of the M-520 decade are relays with high current capability and foil capacitors with polypropylen dielectric.

Important feature of the decade is easy recalibration capability. Process of recalibration consists of measuring of partial capacitors inside the instrument and saving new calibration values into internal calibration memory. For recalibration purpose simple application program is delivered with the unit.
Remote control RS-232 or USB (optional convertor).

Specification

Residual capacitance Co	typ.< 2 pF with floating terminal L and 00000 setting typ. < 10 pF with grounded terminal L and 00000 setting
Number of decades	5
Accuracy	2.5 % ± 1pF for decade x 100 pF 0.25 % for all others
Temperature coefficient	< 250 ppm/°C (polypropylen dielectricum)
Maximal allowed voltage	50 V DC (Imax 1.5 A), 35 V AC (Imax 1 Aeff)
Test voltage	500 V DC between GND and L/H terminals in floating connection
Frequency range	40 Hz to 1 kHz
Connection	two-terminal
Typ of terminals	instrument gold plated terminals, diameter 4 mm
Remote control	interface RS-232, galvanically isolated
Power supply	internal battery 12 V type LONG B-WP 1.9-12 power line adapter 15 V/1 A (100 – 240 V)
Operating period	typ. 4 hours from internal battery, continuously from power line adapter
Reference temperatures	+23 °C ± 2°C
Range of working temperatures	+5 °C to 40 °C
Range of storing temperatures	-10°C to +50 °C
Dimensions	W 364 mm, H 111 mm, D 316 mm
Weight	4 kg

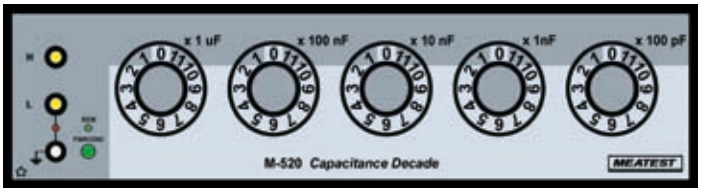
Decade	*Nominal value accuracy * [%]*	*Dissipation factor * [-]*	*Temperature coefficient [ppm/°C]*
100 pF – 1100 pF	2.5 ± 1pF	< 0.05	< 250
1 nF – 11 nF	0.25	< 0.005	< 250
10 nF - 110 nF	0.25	< 0.005	< 250
100 nF – 1100 nF	0.25	< 0.005	< 250
1 uF – 11 uF	0.25	< 0.05	< 250

* at 1 kHz

M-520 Control Panel

Application software is delivered with every unit.
The program is designed to demonstrate capabilities of the capacitance decade in remote mode.

Using the software any capacitance value can be set from control computer.



M525 Programmable Capacitance Box

- **Designed for capacitance meters calibration**
- **Capacitance range 100 pF – 100.00 µF**
- **Capacitance accuracy 0.25 %**
- **Operating voltage 50 V**
- **User defined curves (conversion tables)**
- **RS232 (optionally USB, IEEE488, LAN)**

Model M525 is a precise capacitance decade box with range from 100 pF to 100 µF. Basic accuracy is 0.25 %.
Best resolution on the lowest range is 1 pF. Capacitors are switched using special relays designed for high currents.
Comfortable user interface offers direct setting of capacity value, OPEN correction, grounding L terminal, user conversion curves setting and others.
Decade can be remotely controlled by a computer using standard RS232 interface.
LAN, USB and GPIB interfaces are optional.
M525 is equipped with an internal calibration menu that allows correcting any deviation of capacity value without opening the instrument. Decade is designed for checking multimeters and simple RLC meter.
It is suitable also for repair, adjustment and calibration of measuring instruments.

Specification

Range / Resolution	*Accuracy 1 kHz*	*Loss coefficient 1kHz*	*Accuracy 40 Hz – 1 kHz*	*Loss coefficient 10 Hz – 1 kHz*	*Temperature coefficient*
0.100 nF – 10.000 nF	0.25 % ± 3pF	< 0.05	0.5 % ± 3pF	< 0.05	< 270 ppm/°C
10.001 nF – 100.00 nF	0.25 %	< 0.005	0.5 %	< 0.005	
100.01 nF – 1.0000 uF					
1.0001 uF – 10.000 uF		< 0.05		< 0.05	
10.001 uF – 100.00 uF	0.25 %*	< 0.2 *		< 0.2 **	

Note:
* For frequency 100 Hz
** For frequency range 40 -100 Hz
Capacity value is defined in the output terminals level.
Correction Open OFF – capacity value is defined relative to the OPEN value.
Correction Open ON – capacity value is defined absolutely.

General specification

Maximal voltage:	50 Vpk
Temperature coefficient:	< 270 ppm/ °C
Reaction time:	< 200 ms
Reaction time TIMING :	min 500 ms
Terminals:	gold plated terminals 4 mm
Remote control:	RS232 interface (optionally USB, LAN, IEEE488)
Power supply:	85-260 VAC, 45-65 Hz
Reference temperatures:	+ 21 °C … + 25 °C
Working temperatures:	+ 5 °C … + 40 °C
Storage temperatures:	- 10 °C … + 50 °C
Dimensions:	W 390 mm, H 128 mm, D 310 mm
Weight:	4 kg

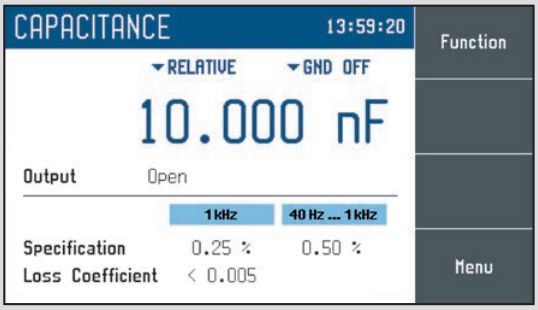
Content of delivery

Programmable Decade Box M525
Cable RS 232
Application software
User's manual

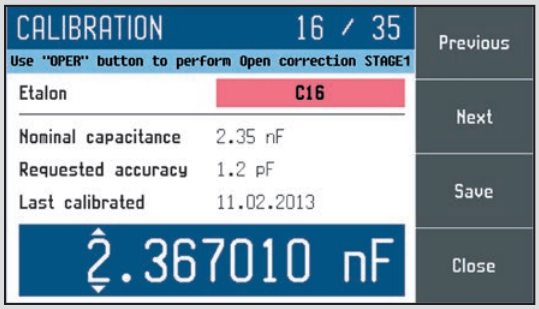
Ordering information – options

Bus	M525-V1xxx - RS232
	M525-V2xxx - RS232, USB, LAN, GPIB
Housing	M525-Vxx0x - table version
	M525-Vxx1x - module 19", 3 HE

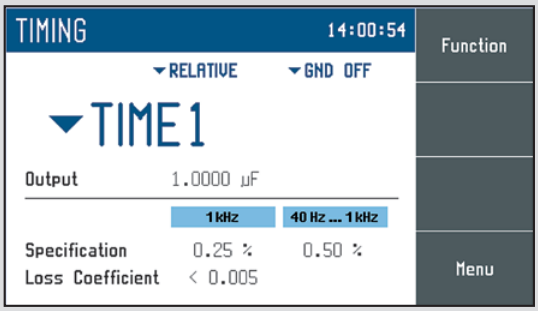
Capacitance



Calibration



Function timing



MEATEST

Exhibitions

MEATEST works in the field of metrology and measuring instruments for 17 years.

MEATEST takes part in worldwide exhibitions every year.

Seminars

MEATEST organises seminars and training courses for customers to help them to get the most out of their investment in calibration instruments and software.

Calibration laboratory

For testing and calibration MEATEST uses its own calibration laboratory. Laboratory is equipped with high precise measuring instruments with traceability to the Czech national standards.

Brno – town in centre of Europe

Brno – capitol of Moravia region is place of company residence.

MEATEST facility is located close to D1 and D2 highways crossing with only

1 hour to Bratislava
1.5 hour to Vienna
2 hours to Prague

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